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THE NATIONAL GEOGRAPHIC MAGAZINE

DOWN THE RIO GRANDE

Tracing this Strange, Turbulent Stream on Its Long Course from Colorado to the Gulf of Mexico

BY FREDERICK SIMPICH

WE SING of *Beautiful Ohio*, or *Swanee River;* but nobody hymns much praise for the Rio Grande—at least not for that long stretch that forms the Mexican-American border from El Paso to the sea. Yet what high adventure this wild, rough region has seen, in all the boisterous years between Cabeza de Vaca and Pancho Villa!

Yet, whether you like to hunt mountain lions, bust broncos, study Indians and ancient ruins, peck around cliffs for mastodon bones, monkey with a captive armadillo—or simply sit in a Mexican cafe, eat tamales and listen to *La Paloma*, you can find your heart's desire somewhere along this extraordinary stream.

Rising on the Continental Divide in southwest Colorado, it flows east, then south, through the Connecticut-sized, 8,000-foot-high San Luis Valley of that State, and continues through steep-walled canyons into New Mexico, wanders across that sunburnt land, and at the western tip of colossal Texas turns lazily southeast to the Gulf of Mexico.

GEOGRAPHIC SURVEYS RIVER'S COURSE

Among all our great rivers, none has such odd aspects, peculiar to itself. Cowboys call it the "world's dustiest river"; robbed by irrigation through three States, it often has little more water in its tired mouth than flows in its cold, aspen-shaded upper reaches. On all its turbulent course, we saw no boats except on the lake formed by Elephant Butte Dam (page 426).

Until the National Geographic Society in 1938 photographed this river, along its whole length, no similar study had been made. Yet anyone can drive his car from the shadows of the Great Divide in Colorado all the 1,800 miles downstream to the Rio Grande's muddy mouth (map, page 419).

On this panoramic ride, by taking a few bumpy side trips, he can gain frequent fine views of the winding river, pass through Indian villages, Spanish-American colonies, and the changing Southwest's last enormous cow ranches—in fact, enjoy a trip surpassed by few in America for profound human interest and majestic scenery.

Start, for example, at Rio Grande Reservoir, formed by the uppermost dam in the creek-fed Rio Grande. At an elevation of nearly 9,500 feet, this artificial lake lies on the wooded slopes of the San Juan Mountains, about 25 miles upstream from the once roaring silver camp of Creede (page 423).

Summer vacation shacks now clutter many beauty spots in southern Colorado, and excited men in hip boots, with sunburnt noses, whip acrobatic trout from pool to pool where once only the bobcats and Indians worried them.

Exploring Spaniards had sought gold and shot Indians here long before the Battle of Bunker Hill; but when Jefferson made the vast Louisiana Purchase from France, in 1803, no white American except Jim Pursley, a fur trader from Kentucky, was known to have seen this upper Rio Grande country.

Photograph by Luis Marden

WHEN FLOODS AND DRIFTWOOD MENACE LAREDO'S BRIDGE, MEN REMOVE ITS ALUMINUM RAILINGS AND LAMP POSTS

No flood is coming now; this demonstration was made to show THE GEOGRAPHIC'S photographer how the job is done in emergency. Over this International Bridge, part of the new Pan American Highway, thousands of American motorists drive annually to Mexico City (Plate XVI and page 447).

Zebulon Pike, marching into the San Luis Valley in 1806, mistook the baby Rio Grande for the Red River, whose source he was seeking. Beaver trappers, following Pike, prowled all these passes and creeks that swell the head of the Rio Grande. Today, beavers, protected by law, are back again and are increasing (page 421).

"They're a nuisance," complained one rancher near Creede. "Last spring I was hauling wood and had to ford Rat Creek; one morning when I got there, the beavers had dammed the creek and flooded the place where I had to cross. To lower the water, I tore out their dam. That night they built it again! Next day I tore it out again. I had to tear it out five times before I could discourage them!"

Creede today is only the ghost of its old boisterous self. Into it a railroad train ventures only once a week! In its hurly-burly heyday, Cy Warman, Colorado poet, wrote of it:

> It's day all day in the daytime,
> But there is no night in Creede.

Here hairy-faced miners from all over the globe once sweated by day and fought by night. Today saloons and dance halls are deserted, or torn down; a big one, famous in boom days as "Bob Ford's Dance Hall," is now a garage.

Ford, in my youth, shot Jesse James, notorious Missouri outlaw; later, we heard, "Bob Ford was killed, out in Creede, Colorado." That was in 1892. By odd coincidence, the first man I spoke to in Creede said, "Yes, I knew Bob Ford. I saw Kelly

Photograph by Texas National Guard

DEEP DOWN IN SANTA HELENA CANYON, A DARK, EVIL SCAR ON EARTH'S FACE, TUMBLES THE TROUBLED RIVER

Three such canyons, in places about 1,600 feet deep, form sections of the international border. Mexico here lies at the right; dry, uninhabited mesa wastes at the left belong to vast Brewster County, Texas. At the canyon's mouth, upper center, the river debouches into a valley of ranches and a few cultivated fields (Plate X).

kill him; he got him at ten feet, with both barrels of a shotgun. I have some old photographs showing Ford's funeral—and what a turnout! All gamblers, all dance hall girls in camp were there. And all barkeepers, of whom we had plenty. One saloon was so big and busy, men said, that the barkeepers had to work on horseback."

WHERE KIT CARSON FOUGHT

Most of the diggings, marked by tumble-down shacks, broken iron cookstoves, and rusted machinery, are now abandoned. Today more people live along this upper Rio Grande than in mining boom days; now they're growing potatoes, beets, hay, and raising sheep and cattle.

Downstream from Creede, along the once stony stagecoach trail, now runs a smooth highway; at historic Wagon Wheel Gap, it curves gracefully past the ruined fort where Kit Carson fought the Utes.

Del Norte, Monte Vista, Alamosa, all are bustling Colorado towns, set along this Rio Grande Valley. Each, in its youth, sowed its wild oats. Alamosa was the black sheep, because it was for a time the terminus of the first railway to crawl west over the snow-capped Sangre de Cristo Range and into the San Luis Valley.

With the new road came many of that robustious and predatory breed who later were to dangle at a rope's end as vigilantes did their duty. To the drooping toes of one such bad man, lynched for molesting a respectable woman of the camp, was tied a

Photograph by Luis Marden

WADDY AND RUBY DO A MEXICAN DANCE, "PUT YOUR LITTLE FOOT RIGHT HERE"

Cowboys, cowgirls, lion hunters, country storekeepers, and schoolteachers from all over the Texas Big Bend Country came to Green's Ranch for this party. Mexican musicians "went to town" with swing rhythms like "Mother Goose Is on the Loose," but bogged down badly when they tackled old-time square dance tunes.

placard which read: "Alamosa Pertects Her Wimmin." Strangest of all cargo, on the first train in to Alamosa, were two hotels and a saloon—lifted and moved by rollers onto flatcars at another town back up the line—over which the boom had swept!

Glistening Alp-like peaks fairly hem in this San Luis Valley (page 425). The only break you see is to the south, on the New Mexican border. Towards that gap the river turns, below Alamosa, and through steep-walled gorges hurries out of Colorado. Remote now from paved roads, though still reached by trails here and there, the runaway stream battles its frothy way through regions of jigsaw-puzzle topography, often so rough that only men on foot can climb through them.

From where your motor road again strikes the Rio Grande bank, below Taos, you pass a steady string of Pueblo Indian ranches and villages until you're far down about Albuquerque.

Somebody said a country is best judged by what its people get out of life. If that is true, this upper Rio Grande Valley is a good country. You have only to find a quiet corner, sit still, and watch the Indians at their field or village tasks to see with what pleasant mien they go leisurely about their simple duties, and in what wholesome comfort they live, surrounded by their families, friends, their fruits and flowers, their crops and flocks.

They stick to old beliefs. Bert Phillips, Taos artist, told me that on one painting trip his Indian model killed a deer. It was getting dark, and snowing, so the Indian hung the deer in a tree, planning to come back for it next day.

When he did, the deer had been eaten by lions and bobcats. Enraged, the Indian hunter mounted a stump and delivered an abusive harangue against the wild animal thieves. Immediately from the forest walked a buck much larger than the one the wild

animals had stolen. Stopping his harangue, the Indian shot this deer.

"Not in a thousand years," said Phillips, "could I have convinced my Indian friend that his abusive speech to the wild animals had not shamed them and forced them to send him another deer in place of the one they stole."

Along this river Indians live now, as for thousands of years, watering their bean and squash patches through crude dams and gravity ditches.

Maps drawn by Newman Bumstead and Ralph E. McAfee

IN WESTERN COLORADO RISES THE TURBULENT RIO GRANDE

Near its source many of John C. Frémont's party froze to death in 1848, seeking a pass over the Divide. Foaming through Wagon Wheel Gap and past pine-clad hills alive with trout and beaver, the river streaks across rich San Luis Valley, then battles its frothy way through rugged canyons into the jigsaw topography of northern New Mexico. The inset is a key to the page numbers of the accompanying maps which depict the course of the Rio Grande.

PETRIFIED BONES DOT THESE HILLS

Through all these gorges and vast gravel beds, what a happy hunting ground for the geologist! Here he can sketch the history of this valley from the Age of Amphibians through the Age of Reptiles, of Mammals, and down to Man.

Long ago seas rose and fell here, earth-crust broke and folded to form the Rocky Mountains, volcanoes erupted and lava flowed and ashes fell and added their plastic surgery to the world's face, and finally made a valley for the Rio Grande. Shot through these cosmic trash piles lie the rich fossil deposits from ages past.

One rare find was a huge turtle.

"Most startling of all," says Dr. Stuart A. Northrop, Professor of Geology at the University of New Mexico, "is the weird mummy of an Aden ground sloth, complete with tendons, claws, and patches of skin and yellow hair, found in a cave near Las Cruces —a strange animal that died not more than a few centuries ago."

Bones of bewildering groups of clumsy reptiles and giant animals are preserved in these hills and gravel beds, like one vast petrified Madame Tussaud waxworks. This frozen menagerie belongs to different ages; here are mastodons, dinosaurs, and many beasts from rhinos and giraffes to ancestral cats and apes; and from the muddy days, salamanders ten feet long.

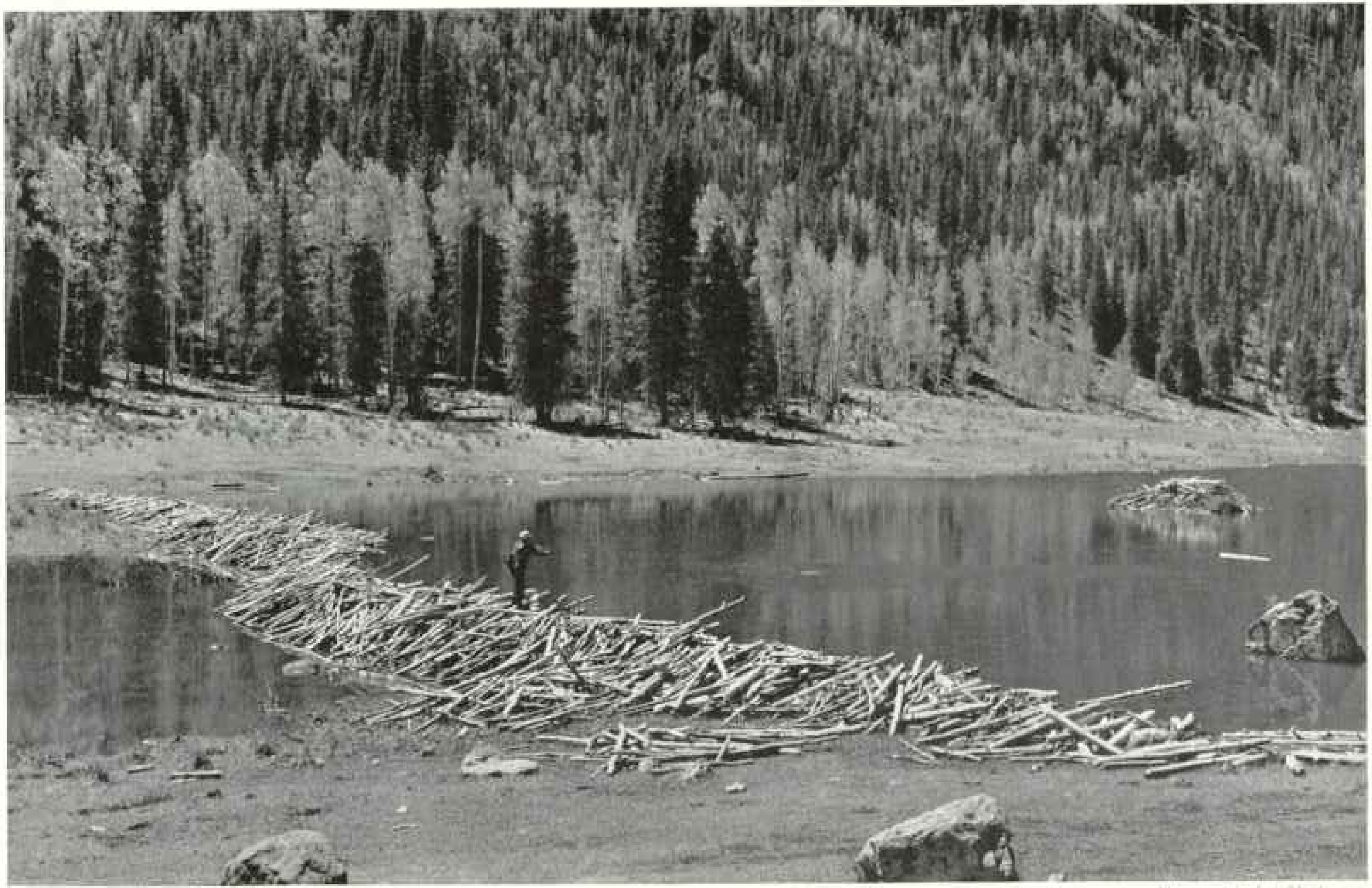
IF DINOSAURS CAME TO LIFE!

In his wisdom, the Creator put men along this river only after such monsters had died. Imagine the panic now if, in some fantastic resurrection, a herd of such creatures might suddenly appear in the streets of Albuquerque just as children were quitting a movie matinee! Tipping over streetcars, smashing foodstore windows to gobble whole crates of cabbages and coconuts, a few such beasts could dominate the city.

Photograph by Luis Marden

HIGH UP ON THE CONTINENTAL DIVIDE ICE-COLD MOUNTAIN BROOKS FORM THE SOURCE OF THE RIO GRANDE

Here the historic stream starts as clear, sparkling snow water; then, for 1,800 troubled, turbulent miles it tumbles through rocky canyons, sprawls across sandy flats, falls over dams, and is robbed by irrigation ditches till at last it slips wearily into the Gulf of Mexico, a sluggish, much depleted river.



Photograph by Luis Marden

BUSY BEAVERS DAMMED THE INFANT RIVER TO MAKE A POND NEAR BRISTOL VIEW

At the right, beyond the jutting rock, rises a beaver house. Aspens and coniferous trees, which provide food and building materials for the little animals, line the slopes. From the dam a forest ranger casts for trout.

Photograph by Rudy Arnold

U. S. COAST GUARD PLANES, BASING AT EL PASO, HELP PATROL THE FRONTIER AND SUPPRESS SMUGGLING

Pursuing outlaw aircraft, these armed Government planes can fly alongside, cover the smuggler pilot, and force him to come down at the nearest landing place. They also make observation patrols, spot suspicious-looking movements of men or vehicles along the river banks, and warn by radio the nearest border land patrol station (p. 453).

Photograph courtesy the Denver Post

MAIN STREET IN CREEDE'S ONCE BOOMING BOISTEROUS SILVER CAMP AS IT WAS NEARLY 50 YEARS AGO

Today, its rich mines exhausted, the dwindling Colorado community is but a ghost town; most of the buildings seen here have disappeared (page 416).

RIVER QUENCHES NEW MEXICO'S THIRST

Through arid lands, fruitful only by irrigation, the north-south Rio Grande trend has formed a travel route since aboriginal days. Here its course is broken by numerous reservoirs.

Only U. S. soldiers with tanks and field guns could stand them off!

Though the middle Rio Grande has no great tributaries, one of importance, the Rio Chama, flows into it north of Santa Fe. Near Chama's mouth lie the ruins of one of America's earliest churches.

Examining old adobe foundations here, we noticed that the bricks were shot through with bits of pottery, fragments already old when they found their way into the mud as Juan de Oñate's men built this first of all New Mexican white settlements in 1598.

Nearing Albuquerque, where man has wrestled with this unruly stream for centuries, its valley broadens to form rich farms.

Fly about Albuquerque today and you see hundreds of miles of new levees, drainage ditches, and canals, wherein giant dredges splash the mud like bygone dinosaurs at play.

HERE FLOURISHED A FEUDAL SYSTEM

The Rio Grande, like the Nile in Egypt, forms a valley down through this State along which man has grown crops for centuries. Harvey Fergusson's book, *Rio Grande*, makes a good pattern for Emil Ludwig's *Nile*, published several years later. Both are tales of civilization along ancient rivers.

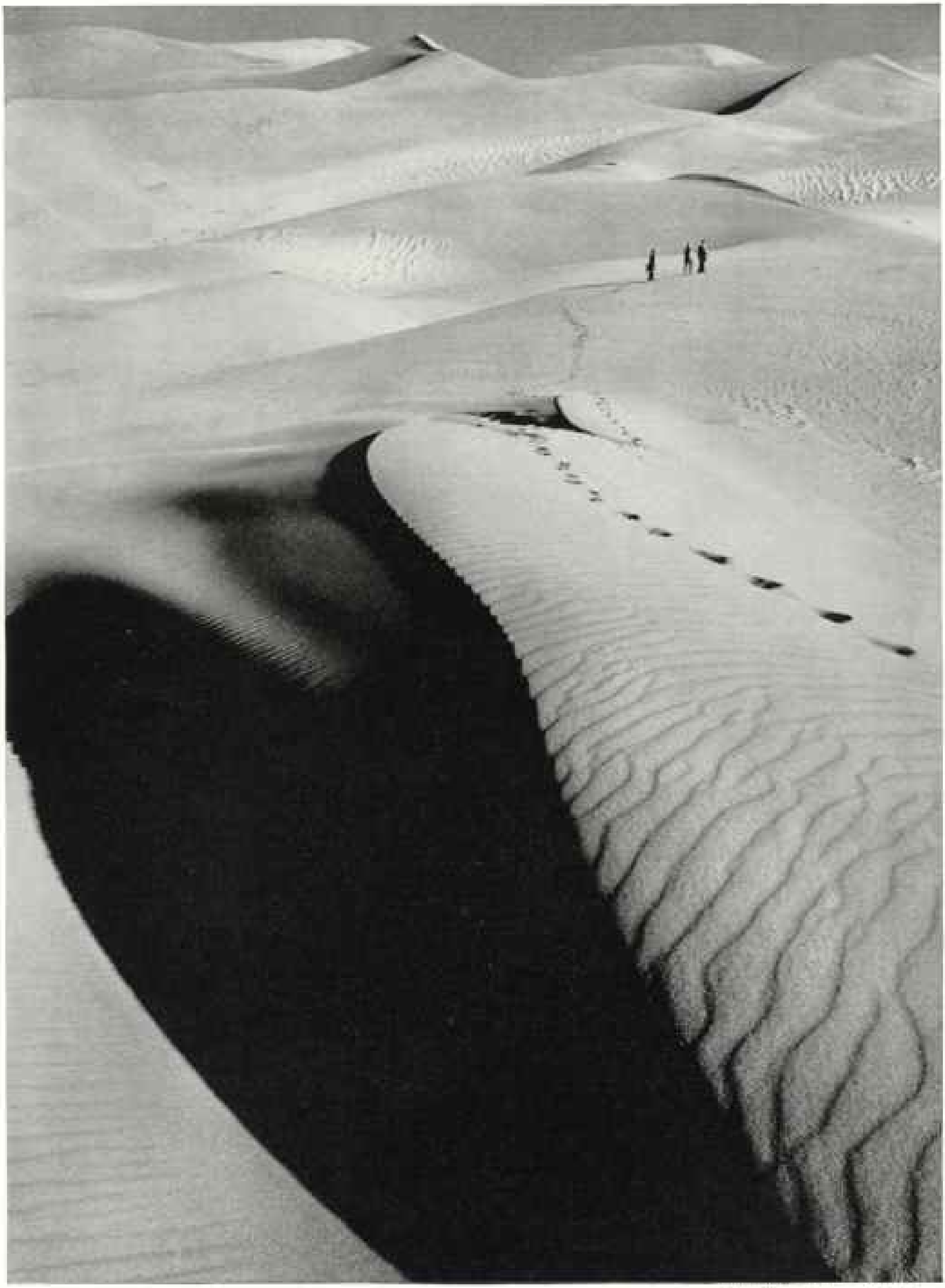
Down this valley, in the shade of cottonwoods, Spanish settlers built their adobe houses, with wide verandas, corrals, patios, and vineyards.

For generations this medieval life prevailed, with all its feudal aspects, Castilian courtesy, rigid social rites—and arrogance.

At such Rio Grande hamlets as Chimayo, Penasco, and Chamisal, you may still find among obscure people something of the perfect politeness to wandering strangers which must have marked the feudal barons for whom their ancestors toiled as house servants and herdsmen. Here are old looms, too, and skill with crude tools, and outdoor ovens, and ways of handling horses which hint at Spanish origin.

Today the names of these first families survive; but their ancestral homes are sand-blown piles of adobes scattered with broken clay pots and tiles.

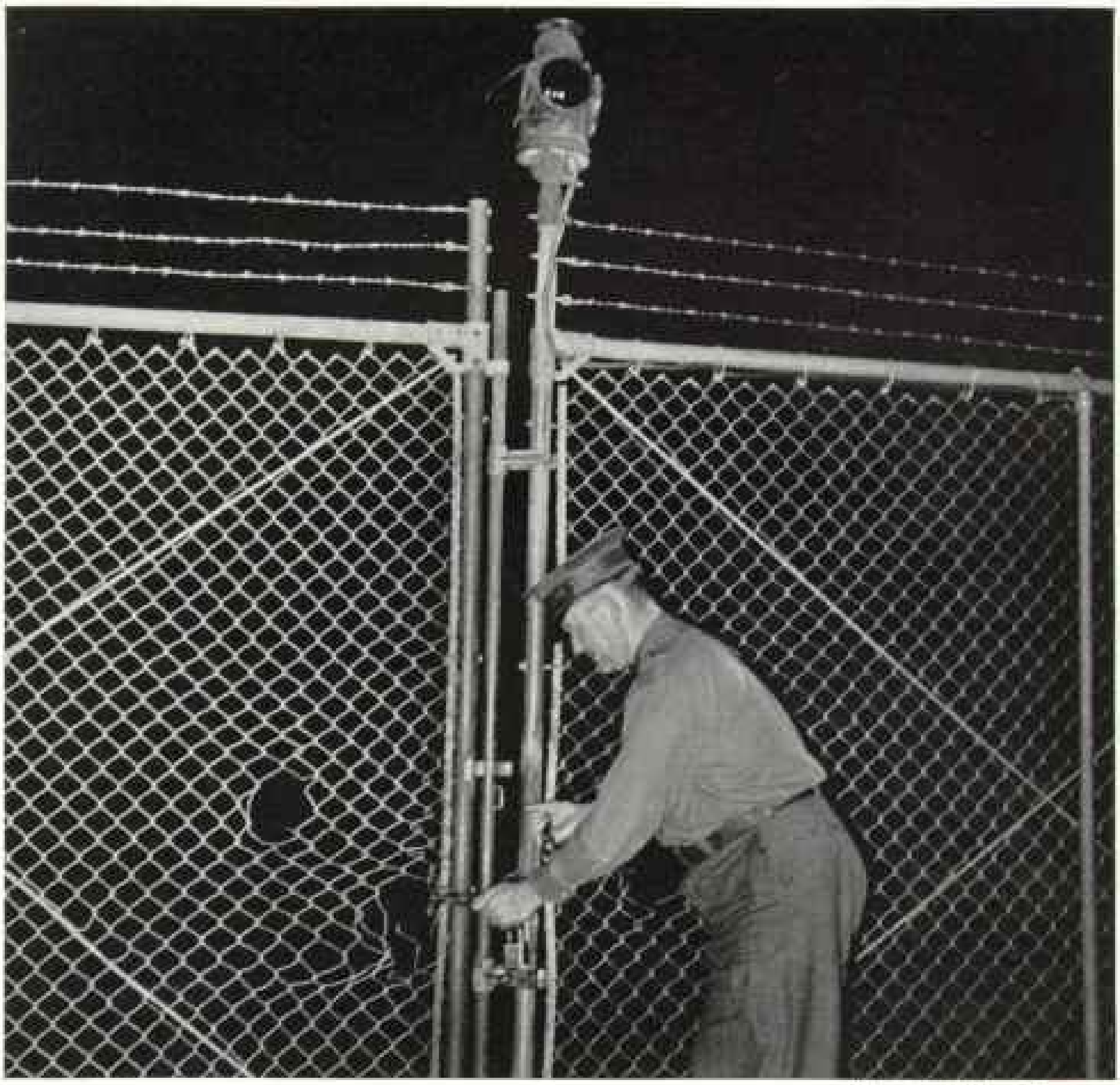
Where their clumsy oxcarts squeaked over sandy trails, the shiny motorcars of visitors whiz now over smooth pavements. High above where Indian runners carried messages on foot now streak the silvery transcontinental planes.



Photograph by Luis Marden

MOUNTAINOUS SAND DUNES RISE LIKE SAHARA WASTES IN COLORADO'S HIGH SAN LUIS VALLEY

Winds, blowing for millions of years from one direction, have moved miles of sand across this enormous, high, hemmed-in area and piled it here in waves of ever-shifting hills. At the dunes' eastern edge, not seen here, trees are being engulfed (page 418).



Photograph by Luis Marden

"IT'S MY JOB TO LOCK UP THE UNITED STATES EVERY NIGHT AND HANG ON TO THE KEY!"

This barricade of iron and barbed wire, topped by a red light, swings shut in the middle of the International Railway Bridge at Laredo, Texas. Promptly at midnight, an American customs guard locks it, and no trains may pass till next morning. Nuevo Laredo, a busy Mexican city, stands at the bridge's other end (Plates I, XVI, and pages 416, 447).

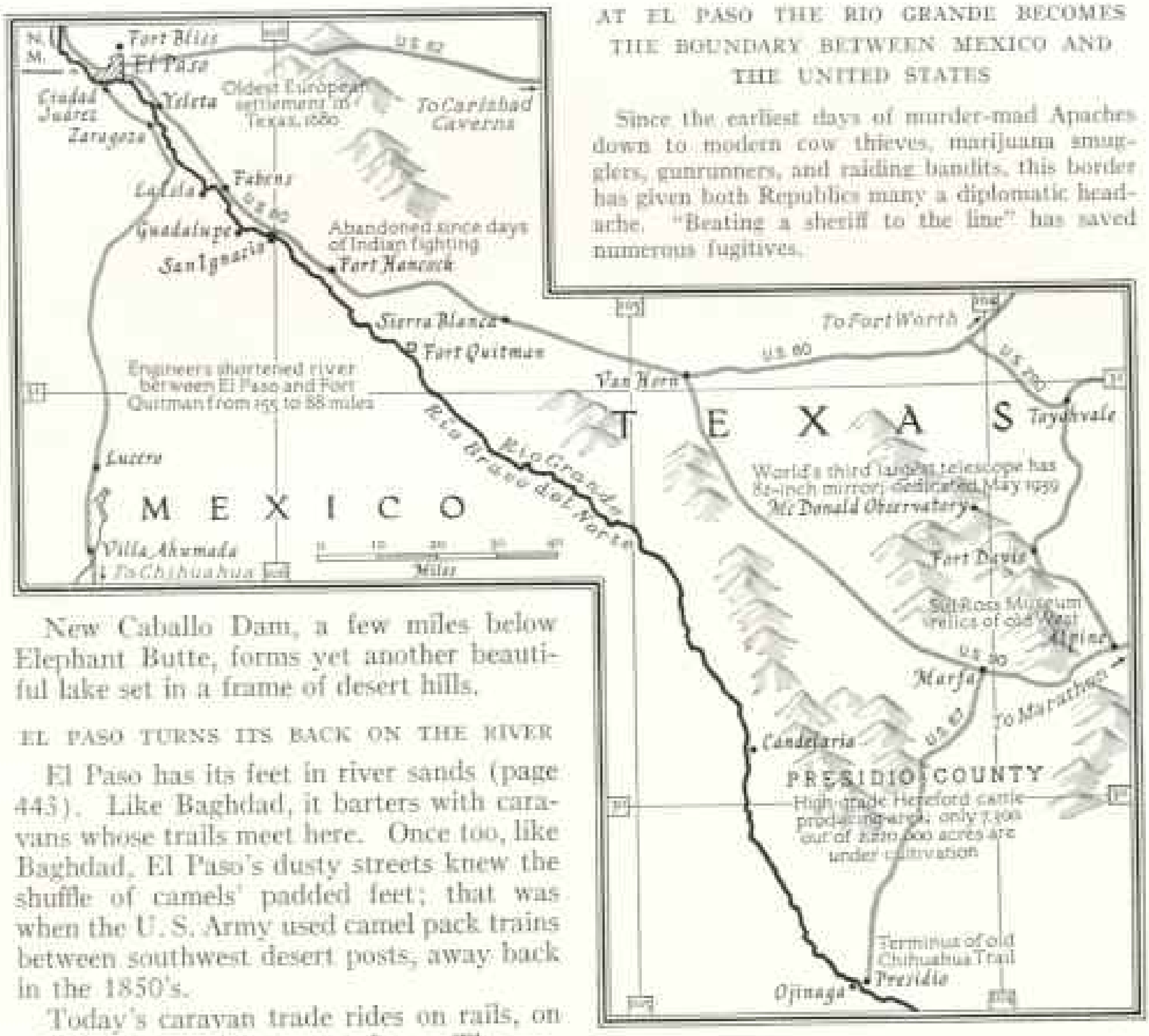
Grocers' delivery trucks carry factory-made bread, cold-storage meat, and chain-store vegetables to modern farm bungalows where the great ranch houses once stood, when Navajo slaves baked their elegant master's loaves, killed his meat, and grew his beans and onions.

PRODIGIOUS WORKS OF MAN

Follow U. S. Highway 85 south along the river, and in spring and fall you see enormous flocks of duck and geese, feeding and flapping and quacking and honking about in game refuges near Lajoya and Socorro.

It is the nature of this wild river, cowboys say, to "run with its shirttail out." Yet slowly, year by year, more of man's hydraulic feats appear, to cramp its liberty.

Elephant Butte Dam, near Hot Springs, forms a 45-mile lake (Plate XIV). Today city men flock here to cast for bass about the lake's brushy shores. At Hot Springs, health resort, beside the lake, stands the magnificent new Carrie Tingley Hospital for crippled children. Patterned after the Warm Springs, Georgia, institution, it employs every curative machine and appliance that money can buy—everything from iron lungs and indoor mineral pools to a factory where individual braces are made.



New Caballo Dam, a few miles below Elephant Butte, forms yet another beautiful lake set in a frame of desert hills.

EL PASO TURNS ITS BACK ON THE RIVER

El Paso has its feet in river sands (page 443). Like Baghdad, it barters with caravans whose trails meet here. Once too, like Baghdad, El Paso's dusty streets knew the shuffle of camels' padded feet; that was when the U. S. Army used camel pack trains between southwest desert posts, away back in the 1850's.

Today's caravan trade rides on rails, on rubber tires, and some on wings. The reason so much trade converges at El Paso is that here the Rio Grande, cutting through the lower tail end of the Rocky Mountains in a prank of geography, forms historic "Paso del Norte," or Pass of the North, lowest of all transcontinental routes, and usually free of snow.

First seen by whites in 1536, when Cabeza de Vaca and his ragged band wandered through here after their Gulf of Mexico shipwreck, this pass in time became the Main Street of the Southwest.

For nearly 400 years, the ford in the shallow river here has seen the singing legions pass—every kind of pioneer, from Spanish general and Mexican field worker to American gold seekers, beaver hunters, Indian fighters, cow-thief avengers—and overland stage drivers.

Four-mule stages, from St. Louis to San Francisco, first to cross the western deserts, began running through El Paso and fording the river near here in 1858. Today's bus and motor lines to California parallel closely this early road. Through here marched the Doniphan Expedition, recruited in Missouri to help Winfield Scott and Zachary Taylor win the War with Mexico.

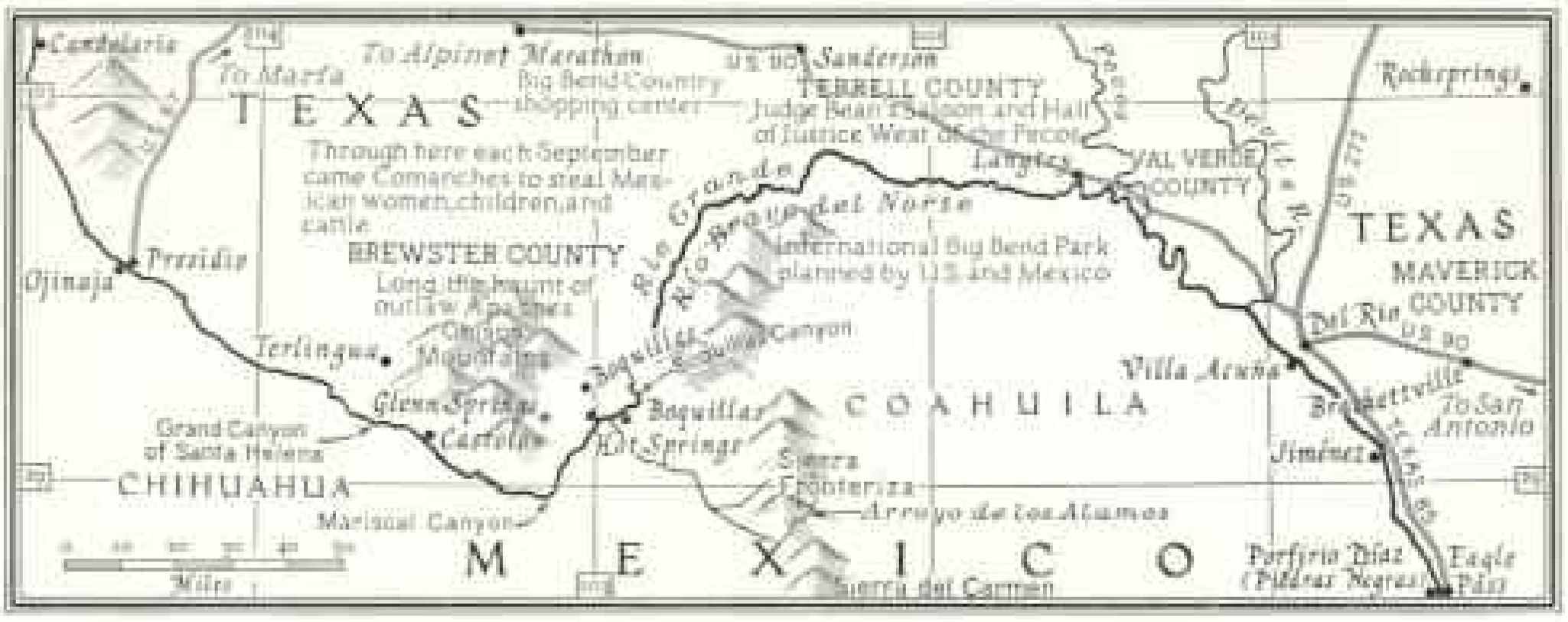
AT EL PASO THE RIO GRANDE BECOMES THE BOUNDARY BETWEEN MEXICO AND THE UNITED STATES

Since the earliest days of murder-mad Apaches down to modern cow thieves, marijuana smugglers, gunrunners, and raiding bandits, this border has given both Republics many a diplomatic headache. "Beating a sheriff to the line" has saved numerous fugitives.

At El Paso the international boundary crawls out of the muddy Rio Grande and runs west over plain and hill to the Pacific; it is marked with stone monuments, set so you can always see from one stone to another.

From high up on Mount Franklin's scenic drive, you look down on El Paso—and Ciudad Juárez, across the river in Mexico—as Nebuchadnezzar looked down from his palace roof upon the beauties of Babylon (page 448).

Through thin, clear air you see the quarters and parade ground of Fort Bliss, Uncle Sam's largest cavalry post; down the valley, smoke floats over busy smelters and oil refineries. Glistening temples to Mammon rise in the heart of the city, flanked by a grim courthouse on whose high top floor is set the city jail; through barred windows



IN THE BIG BEND COUNTRY, RIO GRANDE HAS CARVED DEEP GORGES THROUGH MOUNTAIN RANGES

prisoners enjoy a magnificent valley panorama, and in the cool of the evening you may hear them singing.

Juárez, with its liquor stores, bull ring, race track, cafes, dance halls, night clubs, curio and perfumery shops, and with its noisy market where heaps of vegetables, fruits, and gorgeous cut flowers contrast with fresh meat black with flies, looks, smells, and sounds like any other border town. Yet, to the river, both El Paso and Juárez turn their backs. No boats are here, no wharves, no bustling, colorful water front, as in Memphis or Shanghai.

STREAMLINING THE CROOKED RIVER

From El Paso down to the sea, by treaty of 1848, the middle of the Rio Grande's main channel was fixed as the boundary between the United States and Mexico.

But this reckless river often shifted its channel; people settled near it found themselves first living in Mexico, then in the United States, and vice versa.

To keep the peace in disputed areas, and rectify the border, an International Boundary Commission was set up 1889. Another treaty, in 1933, provided for taking kinks out of the river, and for new levees.

Ysleta, twelve miles below El Paso's smoky smelters, is an old Spanish town in whose mission padres began singing *Venite Laudamus Domino* in 1682. One farm here has been in continuous cultivation for the past 257 years.

Graceful cottonwoods, busy cotton gins, sumptuous ranch houses and California-type bungalows, with here and there a swimming pool or a tennis court, line U. S. Highway 80 as you drive downstream to Fabens.

Below Fort Hancock, abandoned after Indians were subdued, the highway quits the river to join No. 90 at Van Horn and does not return to the Rio Grande until you reach Del Rio, 600 river miles below.

Few people realize how isolated this part of the United States really is. Look at a Texas road map. On it you see that in these 600 river miles no main road at all touches the Rio Grande, except one running south from Marfa to Presidio.

Here at Presidio, and in the vast, wild Big Bend country below it, may be indeed our last frontier. In 75 years, Presidio, long ago a Spanish military post, has changed but little. It is the old terminus of historic Chihuahua Trail.

Toward Presidio once advanced the much-discussed Kansas City, Mexico and Orient Railway. Though never completed, by this bold plan rails were to have linked the Missouri River with Mexico's Pacific coast at Topolobampo, where Kansas City men years ago laid out a town site and built a few miles of track.

Worth visiting near Ojinaga, across the river from Presidio, is a mountain chapel whereby hangs an odd tale. Behind it is a cave wherein, Indians said, the Evil Spirit dwelt. Aided by a priest, Indians walled up the cave and thus put the Devil in jail for life. Each year, on May 3, in the tiny chapel, a ceremony commemorates this conquest of the Devil!

Going back north, you rejoin Route No. 90 at Marfa and go east through Mongolian-like valleys where wild antelope frolic, and on to Alpine, at whose Sul Ross Museum is shown a fascinating lot of relics from old days, including fragments of emigrant wagons burned by Indians, old Spanish

Photograph by Luis Marden

TEXAS RANGERS AND BORDER PATROL MEN LUNCH WITH MEMBERS OF THE GEOGRAPHIC'S RIO GRANDE SURVEY

For nearly 100 years these hard-riding Rangers have been the dread avengers of evil in Texas. Though a clever outlaw may "skip the rope"—dodge justice for a time—sooner or later, cornered by the Rangers, he must "pay the fiddler."

Photograph by B. Anthony Stewart

CORN CAKES, SPRINKLED WITH RED SUGAR, BAKED FOR A MEXICAN WEDDING

In Zapata County, scene of this cow ranch marriage, Mexicans control elections. Texas has some 687,000 residents of Mexican origin, says the 1930 census. All Rio Grande towns, from Taos and Santa Fe down to El Paso, Del Rio, Laredo, etc., are bilingual and Mexican in character.

weapons, and time-faded documents recording the deeds and adventures of pioneers.

From Alpine, Route 90, with mountains on every horizon, leads you east to Marathon, entrance to that strange, isolated region of America—the Big Bend of Texas.

BIG BEND DISTRICT THINLY PEOPLED

Swerving far south to cut a vast piece-of-pie-shaped area of burnt-up desert, overgrazed valleys, and lofty, wooded mountains out of Mexico, the Rio Grande here makes its spectacular "Big Bend" (map, p. 428).

In this caprice of physical geography, the river has scoured its dark, mysterious way through three long rutlike canyons, Santa Helena, Boquillas, and Mariscal.

You might loose half a dozen eastern States in this waste of sun and silence; yet people are few and far between. The tiny quicksilver mining camp at Terlingua, with flat-roofed Arablike houses and no trees, is the nearest approach to a town.

On the Mexican side, towns are even more scarce; even the Mexican customs agent at Boquillas village, having no direct communication with his own country, comes across to Hot Springs to get his official mail!

Consider Glenn Springs. At the time of the "Glenn Springs Raid," that name stood in scareheads on front pages. Yet now it has just three houses! One of these, in ruins, sheltered a few American soldiers that fatal day in 1916 when bandits swooped down on it, set fire to it Indian fashion by throwing torches on its roof, and then shot the troopers as they ran out.

How scattered Big Bend cowboys mobilized and revenged that raid is among the wild and woolly classics of west Texas. The sandy ground hereabouts is still strewn with empty cartridges.

Nobody here has a "near neighbor"; ranch houses are miles apart. At many, daily life is truly primitive. Much of the talk is about lions, water, and cow thieves. Marathon, far to the north, is to these isolated families the center of the world.

"I moved here from Arkansas in 1909," said Sam Neale, who runs a few cattle on the west slope of the Chisos. "Since then mountain lions have killed about 600 of my horses and colts."

Said a woman who rides herd with the men: "Last winter the lions killed all five of my saddle horses." To me they showed a two-year-old filly, badly bitten and scratched, crippled for life by lions.

"But you trap and shoot all the time—" I began.

"Sure," they argued, "but the lions have begun coming across the river from Mexico. Meat is scarce over there; hunger drives them up here." Later, on the river bank, I saw fresh tracks where three had just crossed.

Towering high over the rest of Texas, filled with a strangely assorted plant, bird, and animal life, this Big Bend is often referred to as a "biological island."

Every plant in the Big Bend "either sticks, stings, or stinks," sheep men say. One plant is named "It Blinds the Goat," because fine spines fly off and into the eyes of any animal grazing too near.

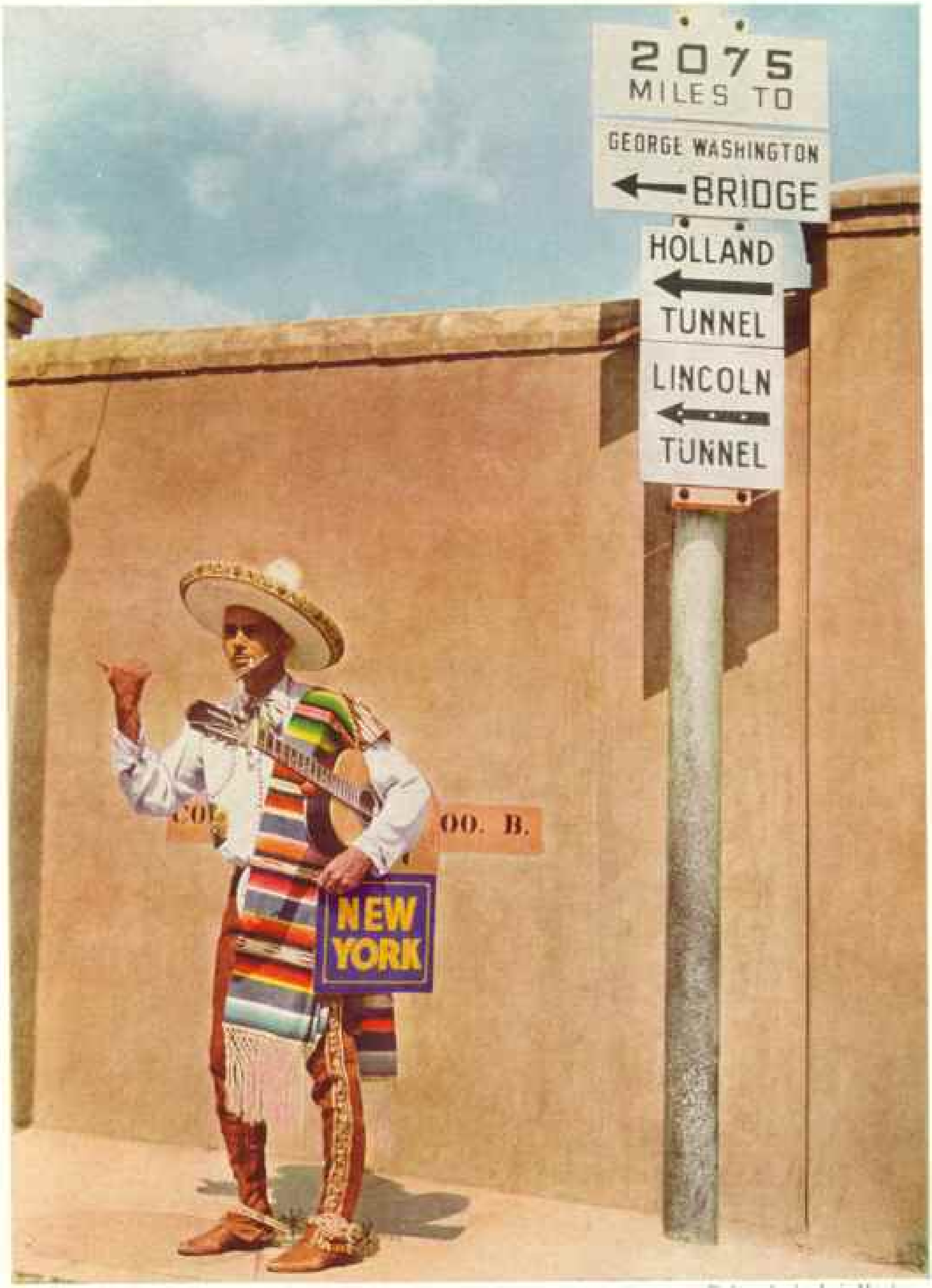
Sheep and goats eat more different plants than cattle do. This makes sheepherders better botanists than the cowboys are; they have a name for every plant, weed, shrub, or flower. But nobody ever sings ballads about sheepherders as they do about cowboys!

One night when I had a tummy ache, they made me tea from the vinegary St. Nicholas plant, and cured me. Lying on the bare ground, you may see what looks like an old leather button lost from somebody's overcoat. That object is in fact a young peyote plant. Mexicans use it as a vermifuge. It has a bad name in the United States because Indians take it as a narcotic. Shoshones and others, living hundreds of miles from the Texas border, make long auto trips down here to buy peyote. They use it as a stimulant in tribal ceremonies.

"That peyote plant can speak," a Mexican told me. "To good men in trouble, it gives advice, on request. It can disappear, too, at will."

Fording the Rio Grande on muleback at Boquillas, we rode south some 40 miles into Mexico, and up into the Fronteriza Mountains. Late one night we came to a goat rancher's home in lonely Alamos Canyon; here a goat man is called a "pastor." This one was much excited; lions had just killed 18 of his goats. In revenge, he dogged the lions up a wooded canyon and shot three. Next morning for breakfast, the "pastor" cooked the youngest of the three lions, and gave us some of the broiled ribs. The cooked lion meat looked and smelled like beef—but didn't taste like it.

On the foot of an old iron bed in the pastor's cabin a parrot roosted. At dawn he flew out, and off into the mountains.



Dufaycolor by Luis Marden

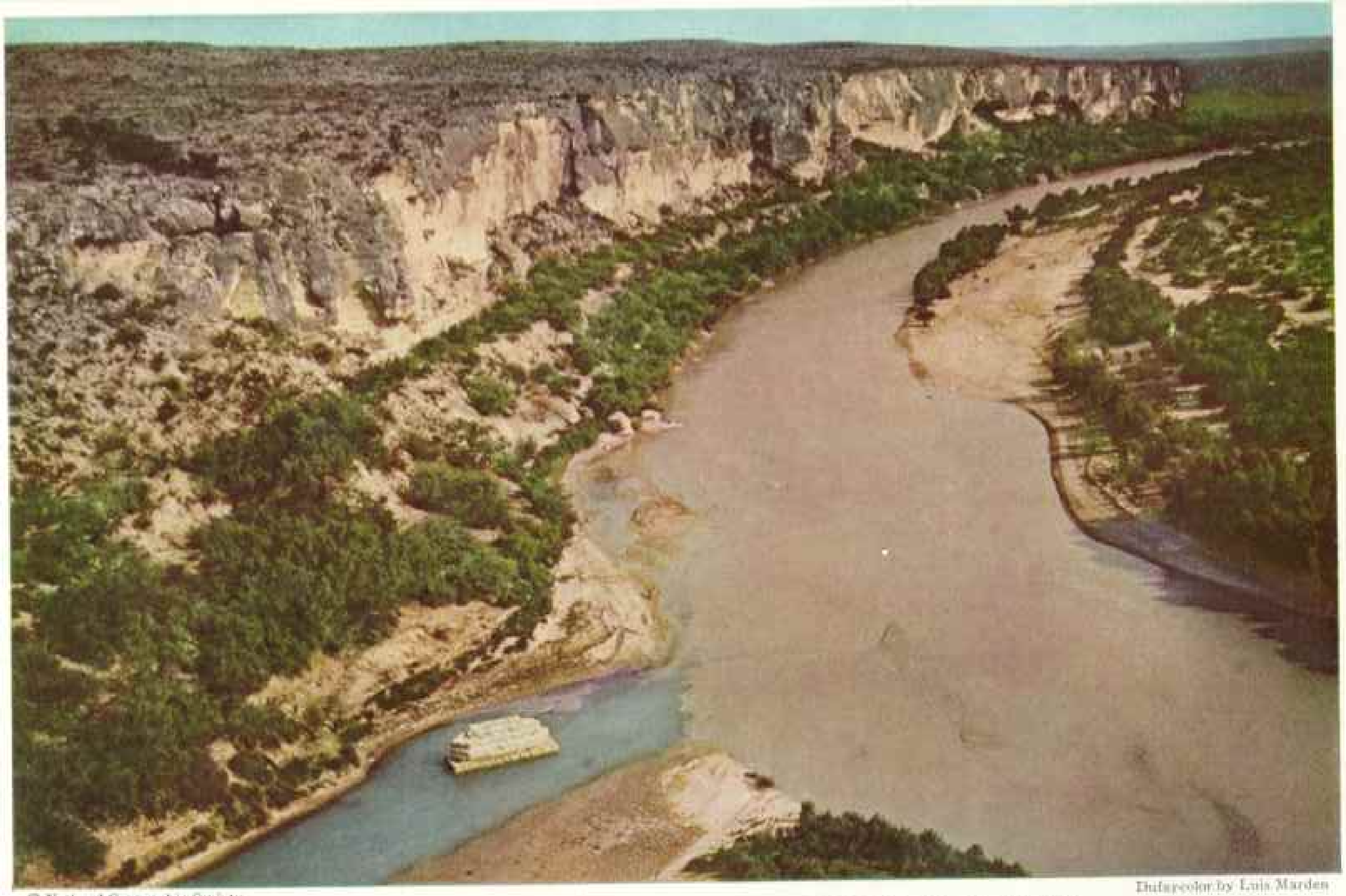
CAN HE MAKE NEW YORK—FROM TEXAS—BEFORE THAT THUMB WEARS OUT?

With his striped serape, big Don Quixote spurs, and precious guitar, he stands, a symbol for hitchhikers, at the American end of Laredo's International Bridge.

Kodachrome by Luis Marden

FOWL PLAY! COME ON, ROOSTERS! TAILS YOU LOSE—AND YOUR OTHER FEATHERS, TOO!

Look at the shadows on the ground. They show how, in this cockfight, one rollicking rooster jumps over the other, to smack him from on high. What looks like false whiskers on the girl in a white shirt is a bandanna, worn for protection against desert dust.



Dufaycolor by Luis Marden

HERE THE PECOS, FLOWING ACROSS WEST TEXAS, EMPTIES INTO THE RIO GRANDE

Cliffs form the United States frontier; lowlands at right are in Mexico. The tree-grown ridge at the cliff's base marks the pioneer roadbed of the Southern Pacific Lines, now relocated on the mesa above. In the Pecos's mouth stands a ruined bridge pier over which once rumbled California trains.

Dufaycolor by Luis Marden

DROP A NICKEL IN AN EL PASO PARKING METER AND HITCH YOUR PONY

This half-Mexican border city is still horse-conscious; many residents are cow-ranch folk. Near-by Fort Bliss, Uncle Sam's chief cavalry post, uses many horses and mules, despite motorized Army transport.

Dufaycolor by B. Anthony Stewart

INSECT PESTS MAY RIDE IN ON CUT FLOWERS IMPORTED BY AIR EXPRESS

These uniformed inspectors are plant quarantine agents of the United States Department of Agriculture. With microscopes they scrutinize every cargo of gardenias and other fresh flowers flown across the Rio Grande to American soil.

Dufaycolor by Luis Marden

BIG AS A BRAIDED RUG, THIS IS ACTUALLY A TEXAS STRAW HAT
She'd blow clear away in a border dust storm! Though the making of huge straw sombreros is a lower Rio Grande industry, such giant wagon-wheel sunshades are braided only as novelties.

© National Geographic Society

Dufaycolor by Luis Marden

IN A LONELY BIG BEND COUNTRY STORE THE CUSTOMER GRINDS HER OWN COFFEE

Far from railroads or main highways, a combined post office and general store forms the whole "town" of Castolon. It is a survival of pioneer days, carrying everything from horse collars and lanterns to cheese, crackers, and bear traps.

Kodachrome by Luis Marden

THIS LOOKS EASY HERE, OR ON A MOVIE SCREEN, BUT TRY IT YOURSELF IN THE THORNY TEXAS BRUSH!

Even leather pants and jackets are not always proof against sharp snags and long thorns. Sometimes even the horse's breast is shielded by a canvas apron. Swinging his riata for a throw, this yelling buckaroo runs a wild steer through mesquite hills below Laredo.

Kodachrome by Luis Marden

TEXAS RANGERS HELP THE CUSTOMS BORDER PATROL ROUND UP A BUNCH OF "WET" CATTLE NEAR LAREDO

A "wet" animal is one which has been smuggled across the river from Mexico into Texas. Such stock may either have been stolen, or merely driven across without the formalities of customs entry or fever tick inspection. A favorite trick of smugglers is to drive a herd across at night, then mix it with cattle already legally at home in Texas.

Kodachrome by Luis Marden

GOING FISHING. FATHER PELICAN TAKES OFF OVER THE STORMY GULF OF MEXICO

Veteran of many a hard hop he must be, judging from his ragged wings and frazzled tail. Till recently, such high-speed color photography was impossible. This exposure was made at stop *F* 4.5 and 1/1000th of a second in a miniature camera.

"He first showed up here about 15 years ago," said the goat man. "Every night, towards sundown, he flies in to roost on my bed, and then flies away again every morning. We don't know where he goes."

From the goat camp we climbed for weary hours up steep, winding trails, coming finally to a high, uninhabited land of virgin forests and valleys deep in grass, marked only by deer paths. On higher ridges stood black trunks of pines fired by lightning; nowhere was any sign of man's work with the ax. About rotting logs, bear had dug for grubs. Here, truly, is yet a "lost world"; here, from the west rim of Carmen's cliffs, you can look out over infinite blue Mexican emptiness and see the Rio Grande curving under the Chisos, leagues to the northwest.

Laboriously our tired mules stumbled back down the long trail; cinches broke and saddles slipped up on the animals' necks, and we rolled off to walk and lead down some almost perpendicular canyon-sides strewn with loose rocks.

Again, at the pastor's that night, the talk turned to lions. And again, as often in the Southwest, Mexicans reiterated that the lion, crouching in brush, waves his tail aloft, thus arouses the curiosity of a colt, a calf, or burro, lures his victim nearer, and then jumps on him. Slipping quietly outside during this lion symposium, Marden, the Boston tenderfoot photographer, suddenly growled with such leonine realism that sleeping dogs sprang up barking, and, for one ridiculous moment, even the veteran Mexican mountaineers glanced anxiously out into the black night.

Back in the Chisos, days later, we camped in the shadows of the peaks.

"Rocks here represent many periods of geologic time," said Dr. Ross Maxwell, geologist of the U. S. National Park Service. "Some are among the world's oldest."

More than once ocean waves tossed over this country. Water stood in depressions, after the ocean receded, and around these lakes and swamps dense vegetation finally grew up.

Dinosaurs enjoyed this environment of marshes fringed with plant life. When one ventured too far into the quagmire and got stuck and died, or was killed in a fight, mud soon covered his body, and his teeth and bones were petrified.

You see such bones now, as well as elephant teeth, fossil oysters thirty inches in diameter, petrified snails, trees, a clam four feet across, and petrified remains of fish, turtles, and sharks—all stored in a small pine shed left by road workers in the basin of Chisos Mountains. On it a wag has placed this label: "A Museum Is a Collection of Labels, Illustrated by Specimens."

These and other wonders of Nature now stimulate the imagination of two Republics. From this Big Bend, and adjacent Mexico's equally sublime landscape, it is planned to form a vast international park, to be made accessible by motor highways from north and south of the Rio Grande.

Far downstream near Langtry, where the steep-walled Pecos pours its alkaline west Texas waters into the Rio Grande (Plate III), you see now all that's left of notorious Judge Roy Bean's once-famous "Saloon and Hall of Justice West of the Pecos" (page 446). With one old lawbook, no legal training, and a six-shooter, Bean meted out frontier justice and supplied plots for a generation of Wild West story writers.

Best known of all Bean legends is this: Finding a dead Chinese, Bean searched him and took off a six-gun and $40. "I'll fine him $40 for carrying that gun and confiscate the weapon," announced the judge! Another yarn says that Bean once chained a lawyer to a tree when the lawyer had threatened to appeal from a Bean decision.

We climbed down into the bottom of Pecos Canyon, followed it to where its greenish waters mix with the muddy Rio Grande, and hunted a cave with Indian paintings. Here are crude figures of men and animals, a group of palm trees, and a sketch suggesting the local course of the Rio Grande, with the mouths of the Pecos and Devils tributaries.

DEL RIO ECHOES TO THE BLEAT OF GOATS AND SHEEP

When we tried to photograph a herd of goats browsing near Del Rio, shepherd dogs on guard drove us back. Brushy landscape here is rich with smells of goats and sheep, and noisy with their bleatings at dawn and dusk.

Only wild animals and a few nomad Indians ruled here in 1590, when Gaspar de Sosa led his band of Spanish colonists across the river on their way to settle in New Mexico. Women and children rode mules, and oxen hauled carts heavy with plows, furniture, and tools for the new homes these pioneers planned to make in the upper Rio

VAST SOLITUDES AND THEN LAREDO!

Grande wilderness. Had two hundred migrating Europeans crossed any river in our eastern States 350 years ago, every schoolboy would know about it. Yet only lovers of Southwest history ever heard of De Sosa!

Armadillos worried the first Del Rio family I talked with. "They prowl at night and root up our flower beds," was the complaint.

Just above this lively town of parks, playgrounds, good duck shooting, and scenic lakes, the Devils River foams over rocky Texas rapids where we saw women in hip boots casting for fish, and tumbles into the Rio Grande. Here our barometer showed less than 1,000 feet above sea level, a drop of more than two miles from the Rio Grande's Colorado source.

By a fine bridge you drive across to the neighboring Mexican town of Villa Acuña, noted for its dinners of quail, duck, and venison.

"After running cattle 15 years down in Coahuila," said a Del Rio rancher, "I have quit there for good. So have many other families. We couldn't stay in Mexico, conveniently, because of the expropriation policy and the agrarian reform laws." In fact, all down the river, from Juárez to the sea, we heard the same story and saw many herds of American-owned cattle being brought to the American side of the Rio Grande.

"Bump Gates" on a rough back-country road we took from Del Rio partway down to Eagle Pass were new to me; you don't have to get out to open such a gate (page 441). You just drive your car against it, it opens, you ride through, and it shuts itself. On this ride we traversed a typical pioneer cow country, with a ranch 50 miles across. It grew dark, and coyotes yelled from lonely hills.

Said a lady of Eagle Pass: "I didn't know I was the tree-climbing variety of woman till yesterday, when I was treed by a wounded javelina. My husband and I were deer hunting; we shot at some javelinas, and one came right for me. People say javelinas never chase you; nevertheless, there I was up a tree, and when I got my breath and looked down, there was friend husband on another limb!"

EAGLE PASS A BUSY PLACE

Since Civil War days Eagle Pass, with its twin Mexican city of Porfirio Diaz (Piedras Negras), has been a busy spot on the border. Here, by a bridge, the Southern Pacific Railway ties up with the Mexican International. On the Mexican side is a railroad division point, with shops, office building, and homes for employees. Piedras Negras boomed furiously years ago, when five or six times as many Americans lived in Mexico as remain there now.

When Eagle Pass's pleasure-loving people are not dining and dancing in cabarets across the river, or off on a hunting trip, it occupies itself with wool, hides, cattle, coal mines, brick kilns, and lumber.

Quail, by the tens of thousands—I saw 80,000 in one warehouse—pipe and flutter in coops, awaiting shipment from Piedras Negras. They come to restock game preserves and estates anywhere from Maryland to California. "To catch them," explained a quail worker, "we put out a wing net and drive them into it. They never really get tame." Even those he had had cooped up for weeks fluttered with fright when we walked near their coops.

Below Eagle Pass your motor road down this valley again swerves far inland, passing some of the largest remaining cattle ranches

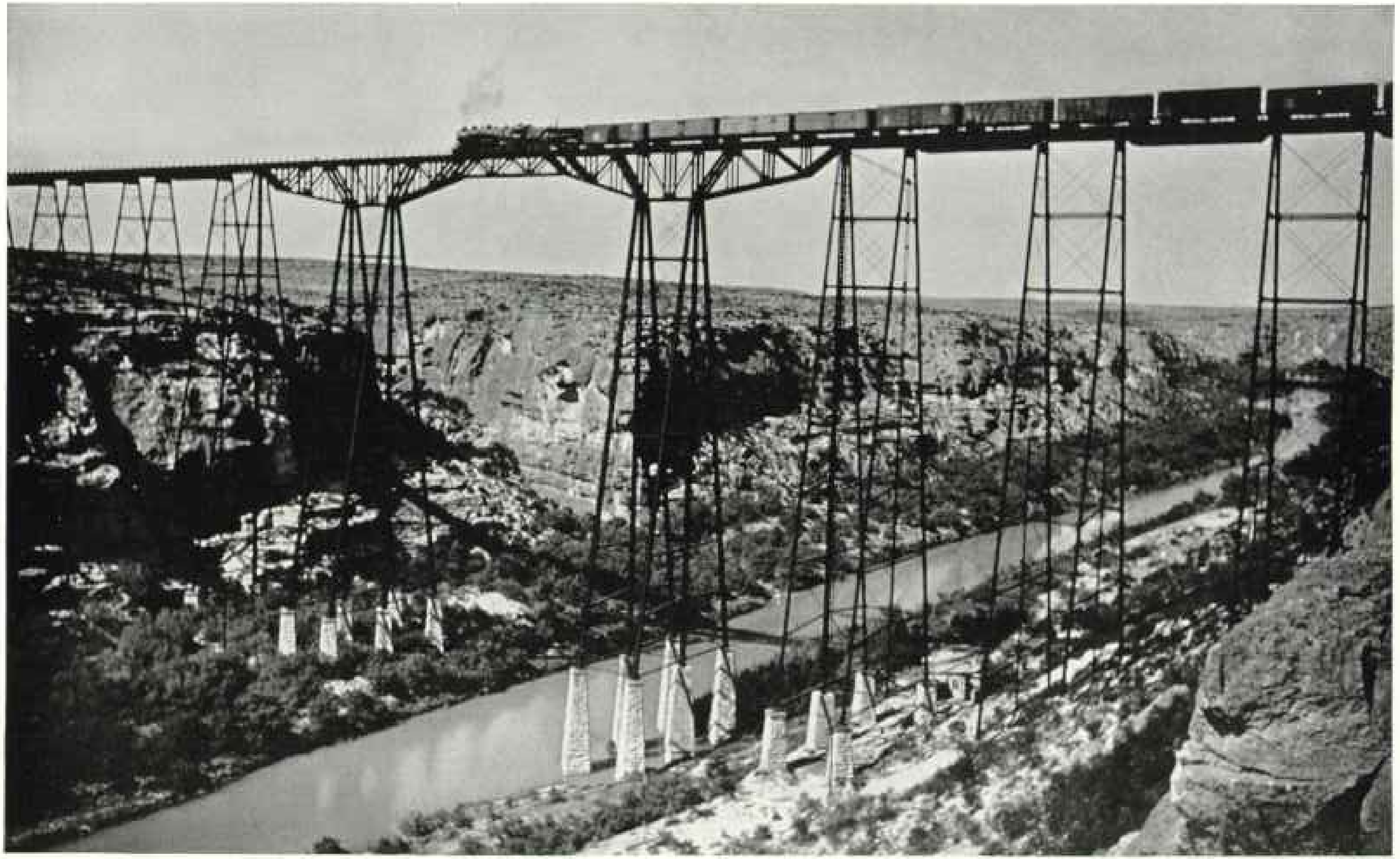
"SIT STILL! YOU NEEDN'T CLIMB OUT—THIS TEXAS BUMP GATE SHUTS ITSELF!"

Cowboys invented this labor saver. Amidships the heavy gate turns on the upright pole. Bumped open by the car, the ropes twist; untwisting, they close the gate on a sheep ranch near Del Rio.

Photographs by Luis Marden

"WHEN MY MULE FEELS A SLOW LEAK COMING, HE BALKS—HE WON'T PULL ON A FLAT TIRE"

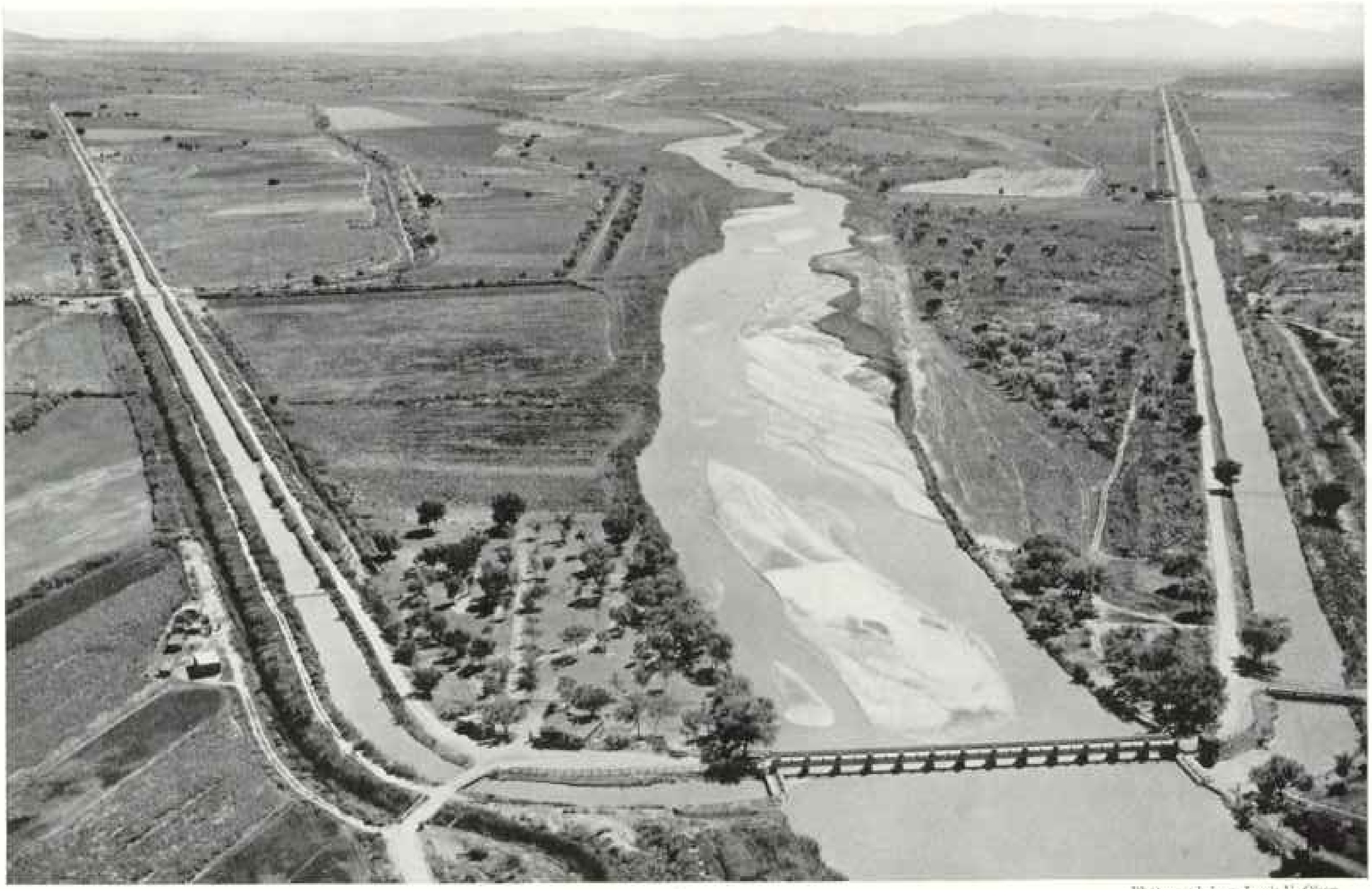
Roman chariots may have been gilded and shaped with more grace, but they never knew the ease of pneumatic tires. In Laredo, Texas, now no vehicle with old-fashioned iron tires is allowed.



Photograph by Luis Marden

THIS DIZZY-LOOKING, SPINDLE-LEGGED BRIDGE SPANS THE PECOS RIVER ABOVE ITS CONFLUENCE WITH THE RIO GRANDE

The Pecos, rising in northeast New Mexico, flows southeast across west Texas, to form one of the Rio Grande's chief tributaries. Here Southern Pacific trains cross the rock-walled canyon on their long runs between New Orleans and California (Plate III and page 439).



Photograph from Louis V. Olson

MESILLA DAM, IN THE RIO GRANDE 41 RIVER MILES ABOVE EL PASO, DIVERTS WATER FOR IRRIGATION

In the distance are the Franklin Mountains, rising above El Paso, Texas, the largest city on the United States-Mexico border. For use of farms on the Mexican side, water is taken off near where the river becomes the international boundary (map, page 427).

Photograph by W. D. Smithers

RANCHERS, TRADERS, BANDITS AND SMUGGLERS FREELY FORD THE STREAM IN THE THINLY PEOPLED BIG BEND COUNTRY OF TEXAS

For hundreds of miles here no large settlements exist. Customs and immigration patrols are few and far between. Food is scarce in this empty wilderness; so, by tacit consent, scattered local residents come and go across the border, with little official interference (page 430).

Photograph by Luis Marden

USING THIS MULTIPLE SHEARING MACHINE, 12 NIMBLE TEXANS WILL CLIP 1,200 TO 1,500 SHEEP A DAY

Moving his truck from ranch to ranch, Miguel Cardenas, of Del Rio, charges 8 cents each for clipping sheep and 5 cents for goats. On the truck, the 12 little shearing motors work independently. Rambouillet sheep predominate in Val Verde County, where this crew shears a flock on the Russ M. Hamilton Ranch.

TODAY PEGASUS MAY FLY ON WHEELS TO SCENES OF BORDER TROUBLES

Here a patrol of the U. S. Bureau of Customs hauls its mounts to distant strategic points for law-enforcement work. That tall, Nebraska-hatted rider is Texas Ranger Joe Bridge. Cowmen say his flat, wide-brimmed black hat is the last of its kind now in daily use in the whole once woolly West! Observe how calm and satisfied the saddled horses are. Why not? For ages they leaned wearily into hard collars, pulling the heavy carts in which they now ride so luxuriously.

Photographs by Luis Marden

DECADES AGO "JUDGE" ROY BEAN'S "COURTHOUSE," NOW LEFT TO RATS AND OWLS, MADE FRONT PAGE NEWS FROM COAST TO COAST

In one crowded room Bean, a singular character, combined his court, saloon, and country store. Racy yarns of Bean's eccentricities, and of how he passed quaint judgement despite his lack of books or legal training, live in the classic annals of west Texas. It is told that Bean once chained to a tree a lawyer who had sought an appeal from a Bean decision (page 439).

in the West. This is a wild, thinly peopled area: you may ride for a score of miles and not see a house.

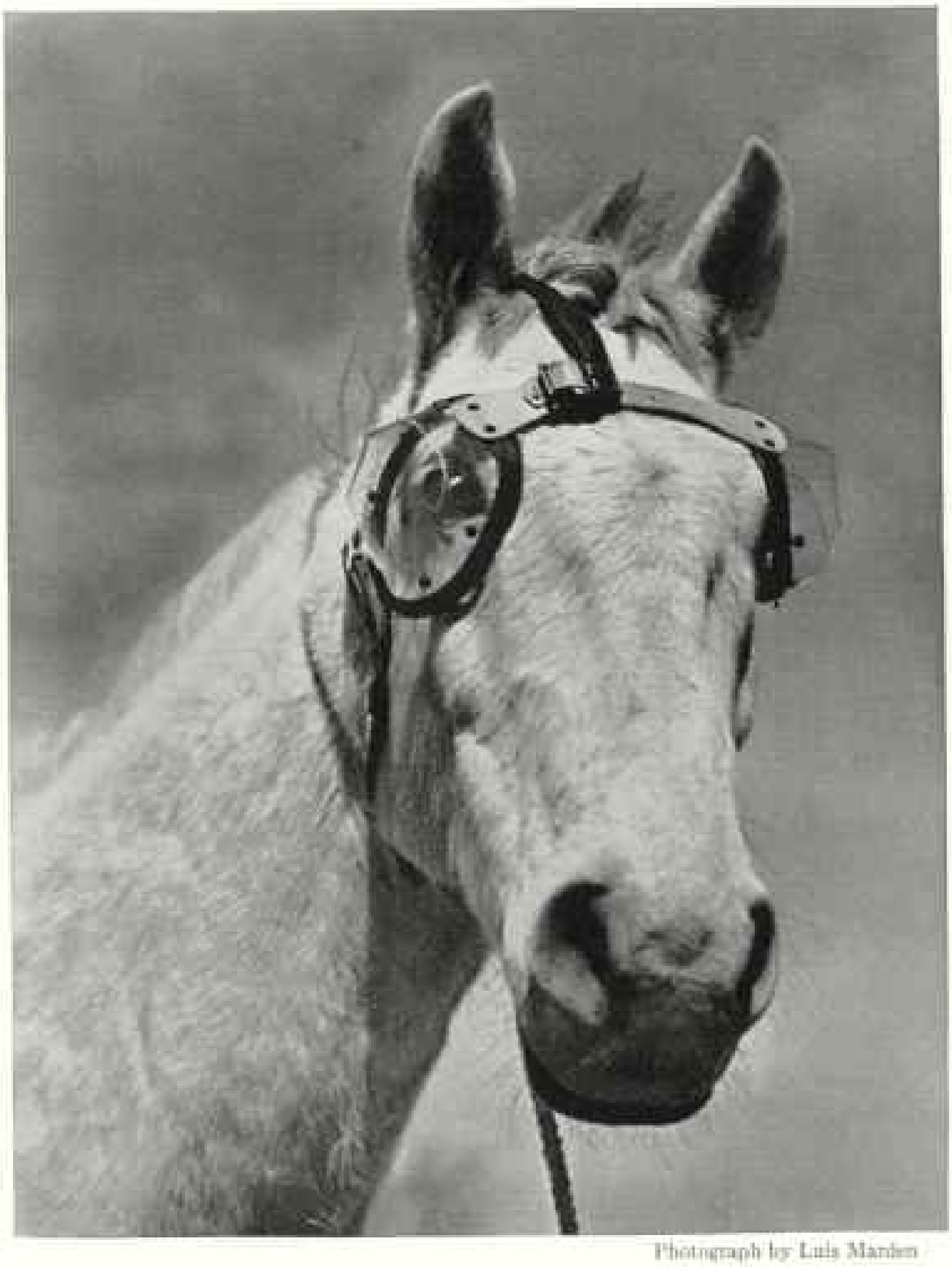
Squads of crows patrol the paved highways, feeding on rabbits, skunks, and snakes killed by speeding cars. Sometimes the sly old coyote himself, blinded at night by headlights, gets hit and pressed into two dimensions. Every successive car pounds him still flatter, till he spreads out like a bedside foot rug!

THE NEW HIGHWAY TO MEXICO CITY

"We're knee-deep in oil, onions, and tourists," they said in Laredo. "In 1938 some 22,500 cars crossed here, taking the new highway to Mexico City (Plate XVI).

"These visitors swarm south with travelers' checks and come back loaded with big hats, serapes, and broken pottery. Some step on the gas and make the 770-mile run between here and the Mexican capital in twenty-four hours."

Thousands of Mexicans lined the hills outside of Laredo one Sunday morning as we watched a Hollywood troupe filming *The Texans*. An immigrant train, drawn up in the familiar old covered-wagon circle for defense, was to be attacked by a band of mounted "Indians"—Mexican boys whose faces had been daubed with war paint by a movie make-up artist.



Photograph by Luis Marden

LATEST TEXAS HORSE FASHIONS GIVE DOBBIN DUST GOGGLES FOR HAPPY MOTORING

Wind, as well as dust, insects, and flying pebbles that might hit the horse's eyes, is deflected by these glasses. They do not help vision, but they do afford eye safety and comfort when a mount rides at high speed in a two-wheeled crate hooked behind a cowboy's flivver (page 446).

For realistic effect, the director wanted the battlefield to be strewn with dead men and dead horses. So they brought along dummies of men and horses stuffed with sawdust. When movie roustabouts began walking down a plank from a sidetracked express car, each carrying a "dead man" or a "dead horse" on his back, the Mexican spectators burst into shouts of derision. When the leading lady, taking time out for lunch, sat down on a "dead horse" to eat her sandwich and hard-boiled egg, the Mexican women onlookers grew almost hysterical with mirth.

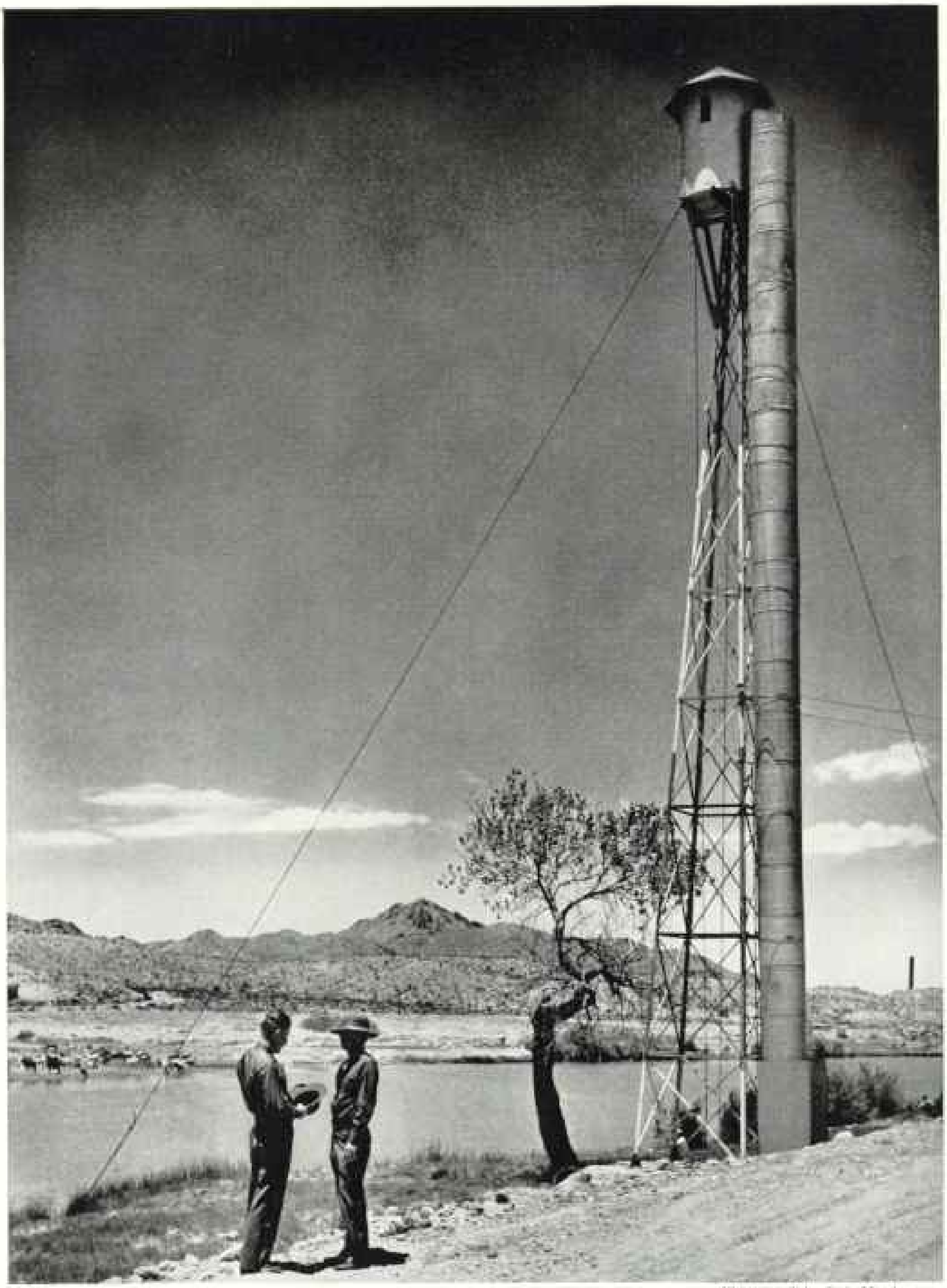
"ALL DAY A SUSPICIOUS CHARACTER HAS HUNG AROUND THE MEXICAN END OF THAT BRIDGE—NOW HE'S TRYING TO SLIP ACROSS!"

From this El Paso observation tower immigration inspectors keep close watch on the Rio Grande banks and bridges, on the lookout for smugglers and persons attempting illegal entry into the United States. Through the window is seen a part of the Mexican city of Juárez.

Photographs by Luis Marden

SOME ISOLATED RIO GRANDE MEXICANS STILL STRIKE FIRE WITH FLINT AND STEEL

At the Mexican river village of Ojinaga, Chihuahua, an Indian peon looped some tow about his left wrist and showed Photographer Marden how the modern Boy Scouts may try it. His steel is a bit of an old rasp.



Photograph by Lois Marden

BORDER PATROLS OF THE U. S. IMMIGRATION SERVICE TALK THINGS OVER AT A WATCH TOWER BELOW EL PASO

Cattle are seen drinking across the shallow, sluggish stream, on the Mexican side. American residents on one bank and Mexicans on the other mingle freely in friendly business intercourse, but official scrutiny of the boatless border river is tense, constant, and vigilant (page 448).

"WHEN WE GIVE POPEYE THE SPINACH, HE HARDLY KNOWS HIS OWN STRENGTH—FEEL THAT MUSCLE!"

From rich, irrigated Rio Grande Valley fields about Crystal City, Texas, trainloads of spinach are cut, iced and shipped each season. There, in honor of Popeye the Sailor, patron saint of spinach farmers, this ridiculous effigy was erected.

Photographs by Lois Marden

"HORSE THIEVES FROM ACROSS THE RIVER SHOOT AT US NOW AND THEN—BUT WE'RE STILL HERE"

She's bona fide—one of the few still-surviving, honest-to-goodness cowgirls. She "rolls her own," can ride anything with hair on its back, and helps her husband manage a successful ranch near Glenn Springs, Texas (page 430).

Photograph by Luis Marden

CLOUDBURSTS WEST OF SANTA FE SUDDENLY FILL UP DRY ARROYOS WITH WHITE FLOODS RACING DOWN TO THE RIO GRANDE

The aerial camera caught the mud-whitened tributaries—merely dry washes except immediately after heavy rainfall—just as they began running full. Often the spearhead of such a sudden canyon flood forms a rushing wall of water from 3 to 10 feet high. Pushed ahead of it or tumbling along with it may come boulders, brush, fence posts, dead burros, or cattle—in fact, every loose object which lay in the bottom of the dry wash.

THIS MEXICAN SEAGOING FLIVVER IS USED FOR CROSSING ESTUARIES ABOUT THE LOWER RIO GRANDE

Rendered amphibious by its pontoons, it easily crosses inlets and lagoons where no bridges exist, and takes to the water when roads are impassable. A propeller, attached to the driving shaft, is used in water; the man with the lever throws the propeller "in gear." This picture was made south of Matamoros, at a channel connecting Laguna Madre with the Gulf.

Photographs by Luis Marden

NO MATTER HOW GRAY AND DEAD-LOOKING, THIS DESERT PLANT, PUT IN WATER, UNFOLDS FRESH AND GREEN

The author pulled the two, shown here, one hot day in the Big Bend Country. That night he laid one in a pan of water; the other, held in his left hand, remains as it was when plucked from among the hot, waterless rocks. Mexicans call it the *siempreviva*—"always living."

THE BORDER SHIFTS CONTINUALLY, WHERE THE WEARY RIVER COMES FINALLY TO THE SEA

Despite many dikes and barrages, the Rio Grande sometimes overflows its banks to flood the rich Texas Delta Country. When such floods change its course, the Boundary Commission faces the problem of readjusting the international line.

Vice President Garner, a familiar and beloved figure in Laredo, is also known by sight to many a Rio Grande fish.

"The yellow perch is my favorite," he says; "but the cats in that river grow as big as hogs. Some whoppers come out of the deeper holes."

And some tales are bigger even than the fish! They told me of one cowboy who tied a grabhook to his lasso, baited it with a goat leg, and hooked a catfish so big that even with his cow pony helping to pull he could drag the cat only to the river bank. Undismayed, he heated his branding iron and put his mark on the fish, and then let it go! "It's mine now," he said. "It's got my brand on it; nobody else can claim it."

Lower Rio Grande speech is salty. Of a loyal friend, men say: "He'll do to ride the river with." Winter underwear is "the long-handled kind," and the tight-kneed, ham-legged riding breeches of a visiting dude are "choke-bored pants." Lazy Mexicans say, "God gave us the nights to sleep in, and the days to rest in."

Anything that's been brought across the river unlawfully is "wet."

With Texas Rangers we went to watch the seizure of "wet" cattle (page 429). Thieves had driven these animals through the river and mixed them with cattle of Texas brands on our side of the stream. Rangers rode through the herds, picking out the "wets." River-bank shooting scrapes, between law officers and lawbreakers, are all in a day's work.

I talked with one cold-eyed border patrolman who had 27 notches in his gun. Since 1914, he said, about 2,300 men have been killed on the Texas side of the Rio Grande, counting both Americans and Mexicans. "Things were worst when rebels were raiding across the line," he explained. "They're much quieter now; the most serious trouble we have is with smuggling. Even that's funny, sometimes. One fat old gal at Laredo worked a slick trick. She filled cow guts with mescal, wrapped these around herself, under her petticoats, and walked boldly across the bridge into Texas. Spotting her odd bumps, our woman agent promptly unloaded her!"

Alcohol, in five-gallon tins, is often smuggled by air. A plane can haul a big load, and land it at some lonely spot far up in Texas or Oklahoma.

"At El Paso, they keep a Coast Guard plane; it often comes to our aid," said the patrolman. "Once we chased a suspected plane; we flew right alongside it and I covered its pilot with my rifle and pointed to a landing field ahead. He nodded, and landed. We followed him down, arrested him, and confiscated his plane and a huge lot of cane alcohol made away down in Sinaloa (page 422).

"Marijuana we always look for; lots of it comes over, in the form of the dried plant, smuggled in feed bags, in the rumble seat of cars, or hidden in baggage. Some is sold, rubbed fine to imitate smoking tobacco, and carried in second-hand tobacco tins." They showed us seized marijuana plants, which resemble hemp. How familiar all this is to many an old soldier who saw border service!

In American homes from Maine to Cali-

fornia, the Lower Rio Grande pictures shown with this article will awaken memories among thousands of men, grown a little gray now, who served here with the Regulars and the Volunteers during the border troubles of 1911–16, when news of raids, sniping, killings, and other "incidents" filled our daily papers.

THE WEARIEST RIVER RUNS FINALLY TO THE SEA

Today solitude and emptiness hang over long stretches of this lower river country. Most old-time army posts are deserted—in ruins. Terrell County, Texas, has less than one man per square mile. South from Catarina, on U. S. 83, we saw two houses in 43 miles. Zapata County has only 736 voters; more than 700 of these are of Mexican blood. When early-day U. S. Army men surveyed here, they saw frequent bands of wild horses, and deer in herds of two and three thousand.

Along a rough, brush-lined, lonely road from Zapata to Roma, we saw Mexican boys with dogs hunting bobcats. Some homes had "varmint-proof" hen houses. Old ways of life linger. About an open-air clay oven at a Mexican ranch, we saw women bakers wielding long-handled paddles (page 429).

"These cakes are for a wedding feast," explained a Mexican girl. "Making them is almost a lost art; nobody here knows how except these two old women."

Coming into Rio Grande City, you arrive at what used to be a river port. Flat-bottomed steamers puffed this far upstream before the river silted up and grew too shallow for navigation. In an old book I saw a picture made in 1865. It showed the plumed soldiers of Maximilian and Carlotta, with their toylike wheeled cannon, going aboard a steamer at Matamoros; from there they would drop downstream and board troopships waiting in the Gulf to take them back to Europe after the collapse of Mexico's French-fostered empire.

Another survival from old days is land grants, dating from the Spanish kings. I was in a Brownsville law office when one such tract was being sold by heirs of the original grantee, its first transfer since 1761! Such grants usually faced the river for one league, and extended far inland. As one generation after another inherited this land, each heir took his share in the form of a strip, always with river frontage so he might water his cattle. On record today is one such strip which is actually only thirty-six inches wide at the river and runs inland twelve miles! It is, however, not fenced off, but farmed by neighbors.

As I write this, Brownsville, on the Delta, is one of the busiest cities in the United States. Grapefruit made it so, as already told in this Magazine.*

Air travel helps. Here the giant skyliners of Pan American Airways halt to satisfy international border rules. Weary passengers alight to rest their ringing ears and stretch their cramped legs. Men in uniform rummage through baggage, turning out knickknacks bought in Buenos Aires, Lima, or Guatemala. With microscopes, plant quarantine men from our Department of Agriculture paw over orchids, gardenias, and other costly cut flowers shipped from Mexico City to Chicago or New York (Plate IV).

Then again the sky-riders hurry aloft, and away to the north—and probably half of them don't even know that the name of that muddy stream they just jumped was the Rio Grande!

Fifty-five miles downstream is the Gulf, river's end. Zachary Taylor landed here, in the War with Mexico, ninety years ago. Once U. S. Grant and Robert E. Lee saw service here. In these brushy, mud-strewn flats was also fought the last battle of the Civil War; a monument says so, but few stop to read it. On the Mexican side of the river's mouth once stood a town named Bagdad; it's a ruin now. It flourished when Confederates ran cotton from here to England, dodging Union gunboats.

Today, girls in shorts fish here for tarpon. Barefoot boys chase sandpipers, or drag a dead baby shark on a string. In warm, sunny winter, elderly Iowa and Missouri couples, chased south by cold and snow, wander along the beach looking for shells. Some take a boat for Padre Island, off the river's mouth, and talk with imaginative fishermen there about the buried treasure of Pirate Lafitte. Others hurry back for an enchilada dinner, across the river in Matamoros, or go to the movies.

Few indeed, near the Rio Grande's mouth, have any idea of what wild scenes, what mysterious Indian life, what mastodon bones, beaver, and snowdrifts are scattered up its 1,800 turbulent miles.

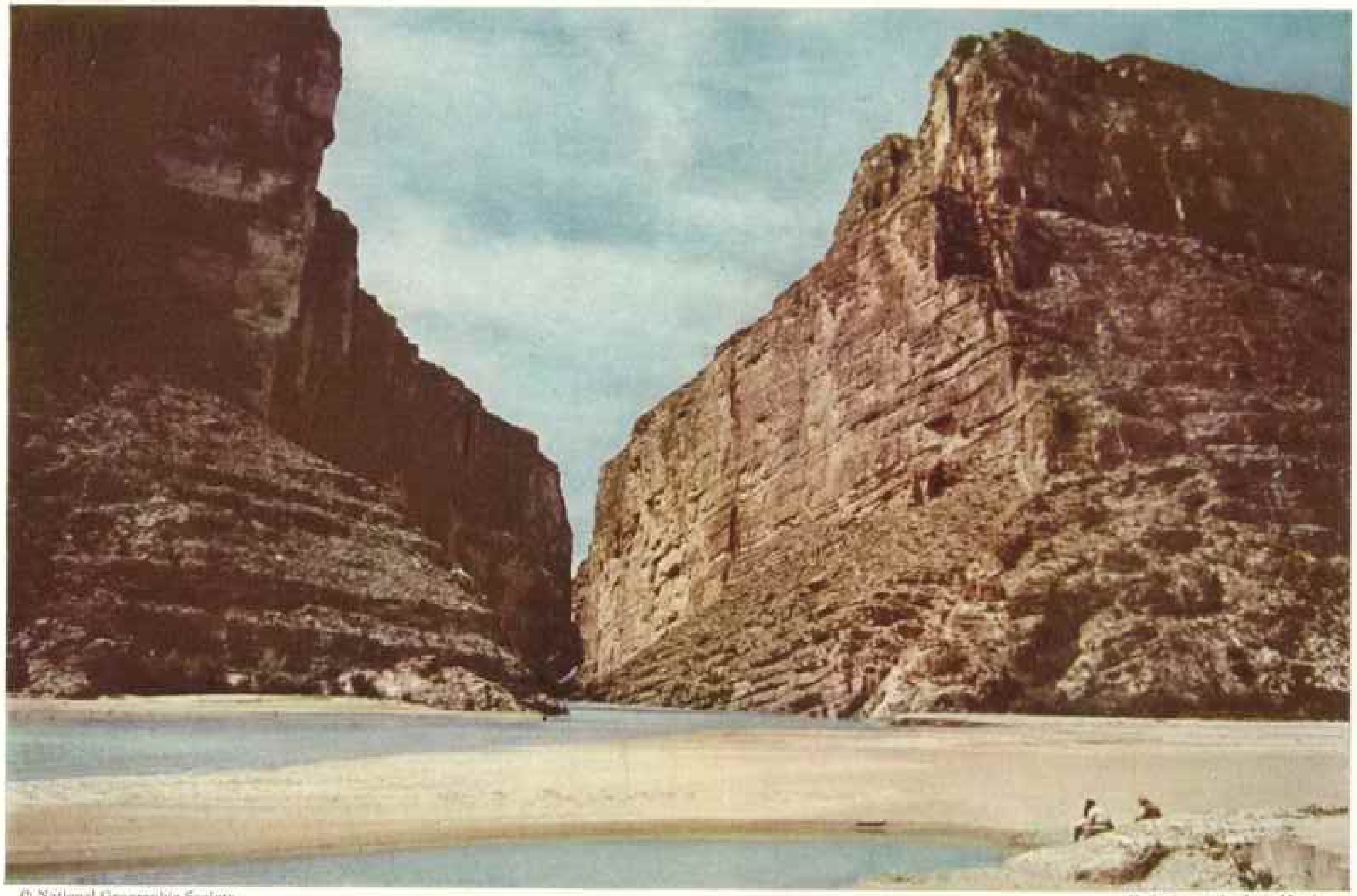
* See "The Texas Delta of an American Nile," by McFall Kerbey, in NATIONAL GEOGRAPHIC MAGAZINE, January, 1939.

NOT EVEN HER SUNBONNET CAN HIDE HER MILLION-DOLLAR SMILE
In the hot winds of west Texas summers old-style headdress still proves satisfactory. Even the greenest tenderfoot soon learns to avoid contact with dagger-pointed desert plants, like this yucca.

Kodachromes by Luis Marden

DESCENDANTS OF EARLY TEXAS SETTLERS GIVE A PIONEERS' CLUB PARTY

Round dances, in costumes of covered-wagon days, were held on the campus of Sull Ross State Teachers' College, at Alpine. Interesting relics of early days, from hand coffee mills to bullet molds and fragments of wagons burned by Indians, are displayed by the local historical society.



Kodachrome by Luis Marden

DEEP, DARK SANTA HELENA CANYON MARKS THE BORDER BETWEEN BREWSTER COUNTY, TEXAS, AND MEXICO (LEFT)

Wild, rugged, and but sparsely inhabited, the Big Bend section of the Rio Grande was for years the refuge of renegade Indians, outlaws, and smugglers. Now new motor roads are creeping in, camping parties appear, and plans are afoot to convert the vast wilderness into an international park.

$45,000 IN MEXICAN SILVER BARS REACH THE BORDER AT LAREDO, TEXAS

From Real del Monte Mines at Pachuca, these bars were hauled across the International Bridge in an open cart, unguarded. But try running with one in each hand; they weigh 72 pounds apiece!

Kodachromes by Luis Marden

SADDLE MAKING IS STILL A BRISK TRADE IN ALL RIO GRANDE COW TOWNS

Here Fidel Cantu, Laredo's veteran saddler, puts his final touches on the future pride of some broncobuster. Every good cowboy boasts his own expensive saddle, bridle, and spurs, and often his own favorite pony.

SINCE SPANISH COLONIAL DAYS PATIENT OXEN HAVE TOILED ON MEXICAN FARMS

Stubbornly disputing the right of way with motor trucks, such clumsy carts still squeak along. The peon keeps to the middle of the new Pan American Highway out of Nuevo Laredo, in Tamaulipas.

 Kodachromes by Luis Marden

FERDINAND'S WIFE SNIVES HAPPILY AT SUCCULENT CACTUS BLOSSOMS

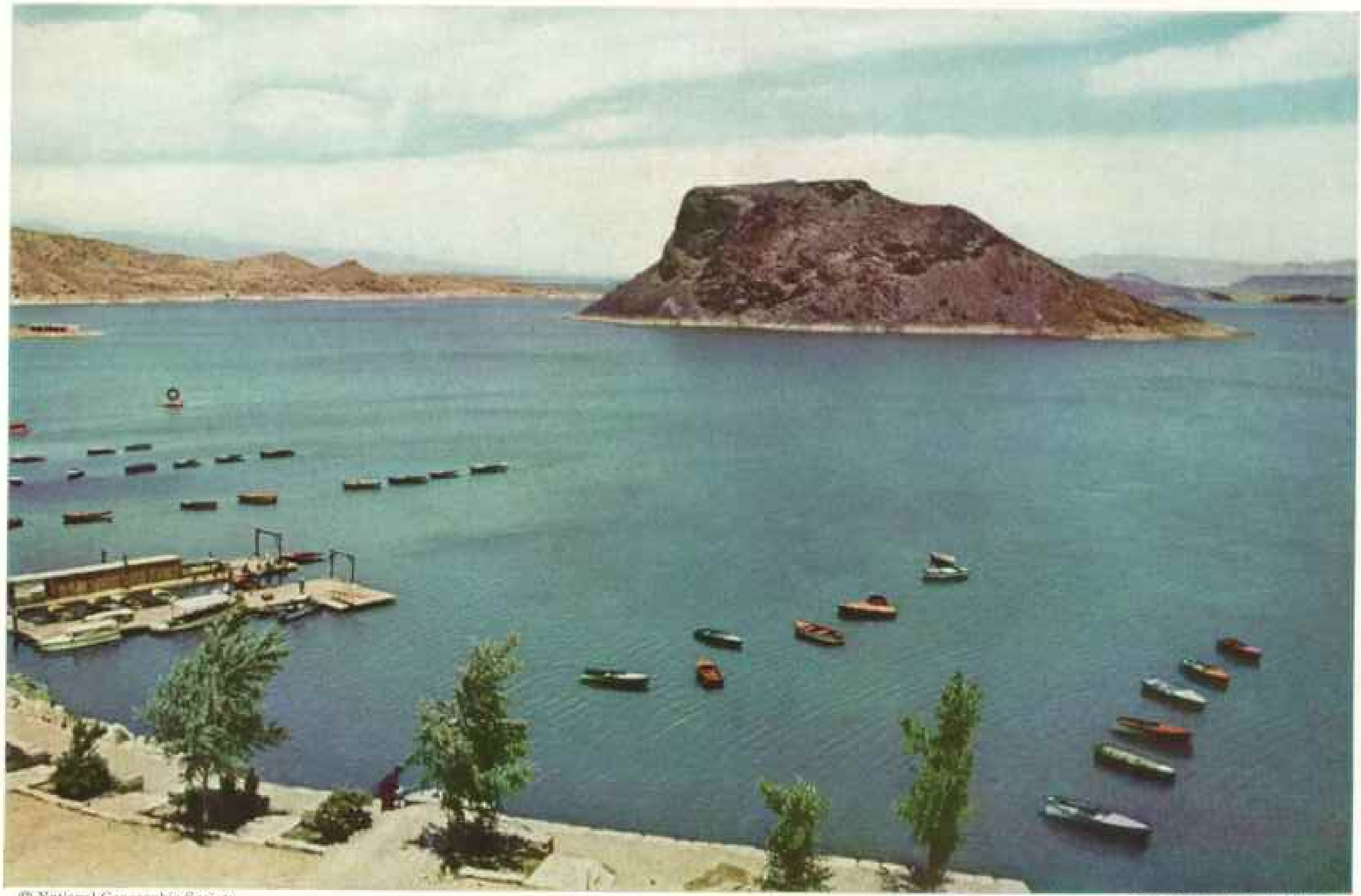
With a gasoline torch the man burns the sharp spines off this nutritious Texas prickly pear. Then hungry cattle may eat the paddle-shaped plant without getting thorns in their mouths and tongues.

TO SEE THE LANDSCAPE WHIZ BY, ONE BOY RIDES BACKWARD ON THE "RUMBLE SEAT"
Too lazy to run away, this philosophical ass needs no bridle. After helping herd goats all day, he, too, is glad to go home and rest in Villa Acuña, in the Mexican State of Coahuila.

© National Geographic Society — Kodachromes by Luis Marden

UNCLE SAM'S TROOPERS WATER THEIR MOUNTS FROM A PORTABLE TROUGH

In maneuvers they marched from El Paso to San Antonio, a mere 600-mile jaunt. When water is warm from the sun, smart old horses sometimes poke their noses much deeper to get a cooler drink.



Kodachrome by Louis Marden

ELEPHANT BUTTE RESERVOIR FORMED IN NEW MEXICO WHEN THE RIO GRANDE WAS DAMMED JUST BELOW THIS BLACK MOUNTAIN

For leagues downstream ranches and cities benefit from the flood-control and irrigation functions of the vast lake. Unique in a land of little water, it also affords fishing and bathing, and is one of the few places on the whole 1,800-mile-long Rio Grande where boats are used.

"GOT A MATCH? MY PIPE'S OUT. YES, I KNOW 75 OTHER TRICKS"

Visitors to Alpine, Texas, halt in stupefaction when they meet this dog walking down Main Street alone, on its hind legs. Its master, who gives the orders, may be 50 yards away.

Kodachromes by Luis Marden

THE GREAT BARD SAYS, "THERE'S NO ART TO FIND THE MIND'S CONSTRUCTION IN THE FACE"

Of what this Navajo girl is thinking, then, you cannot read in her expression. It may be of another Navajo, or of a white girl's lollipop. She belongs to San Ildefonso, New Mexico.

MEXICAN SCHOOL CHILDREN CELEBRATE MAY 5, A NATIONAL HOLIDAY

On this day in 1862, during the first presidency of Juárez, valiant troops repulsed invading French at Puebla. Mexico's Independence Day is celebrated on September 16.

Kodachromes by Luis Marden

"HOW'S THE ROAD FROM HERE TO MEXICO CITY?"

From Laredo, Texas, the Pan American Highway starts on its long drive toward distant Buenos Aires. In many lands, from Mexico to Argentina, sections are already built.

DEER OF THE WORLD

As Workers, Pets, and Graceful "Living Statuary" in Parks and Estates, These Versatile Creatures Have Endeared Themselves to Mankind

By Victor H. Cahalane

"WHO'S there?"

Deep in the mashed potato and chicken of Sunday dinner in the Chiricahua Mountains of southeastern Arizona, I took a few moments to reach the back door of my cabin.

The knock was repeated, this time more impatiently.

As I opened the door, there on the steps was an uninvited guest. Lowering his antlers, he advanced to knock again. I stepped back while he peered into the room expectantly.

Behind him lay the wreckage of our Sunday dessert. Rolling in the dust was the empty ice-cream freezer. Chunks of ice, licked free of salt, were scattered over the ground. The yawning container informed my wife that it would be necessary to open a can of peaches.

Apparently the palates of deer had undergone a vast change since their prehistoric ancestors inhabited the earth!

About 25 million years ago the predecessors of the modern deer wandered over the vast wastes of a primitive world. They had no horns and were neither so handsome nor so large as their descendants are today. No bigger than cats, they scurried through the Oligocene forests, fighting their battles with long saberlike teeth. Somewhere in those lost, mysterious centuries the structure of the deer changed gradually. Most of them grew larger and developed antlers.

DEER AMONG EARLIEST PICTURES

Among the oldest pictures in the world are those of antlered deer carved or painted by our Paleolithic ancestors 50,000 years ago. Some of the deer were 16 pointers!

During the thousands of years slow changes of climate took place. The reindeer of the cold regions and the red deer of the warm regions wandered south and north from their respective homes as the glaciers advanced and receded over the earth. As land rose up out of the waters joining continents, the deer originally inhabiting central Asia probably migrated south over the mountain ranges through northern Iran (Persia) to the Caucasus, and through Asia Minor to the Balkans.

Crossing the Alps, they reached central Europe. From there they moved on to England, or to Ireland, or the Americas. The waters rose again from time to time, sweeping over the land bridges. As the deer became thus isolated, they adapted themselves in form and habits to their new environments.

Modern man has often greatly accelerated the migration, bringing species from one country to another. In the *Gallic Wars* Julius Caesar wrote about the "elch." An early form of the present Spanish bull fight is recorded by Julius Capitolinus' description of 10 elch appearing in the arena with gladiators. The Romans brought the fallow deer to England; the homesick Scots shipped their stag to New Zealand; reindeer were imported to Alaska; and several other species of deer were sent to newly developed countries.

NEARLY SIXTY DEER TRIBES IDENTIFIED

Primitive man knew only a few kinds of deer, but today exploring scientists have named nearly sixty. These are distributed over the entire world, with the exception of central and southern Africa. Although they differ greatly in size, from the vast moose six and a half feet at the shoulders to the dainty little pudu only twelve inches high (Plate VII), there are certain common family characteristics.

The males of all but two species proudly display antlers. In the cold and temperate zones they use these to fight bravely and gloriously in the fall, lose them meekly in the winter or early spring, and devote the next few months to growing new ones for further conquests. Perhaps the struggle is less strenuous in the Tropics, for there the shedding frequently has no fixed period.

"What becomes of the antlers that deer cast off every year? Why don't we see them?" everyone asks.

Photograph by B. Anthony Stewart

FOR A HUNGRY FAWN—THE MILK OF HUMAN KINDNESS

On the road to the summit of Mount Tamalpais, California, a clever young deer is willing to "strut his stuff" to earn an honest meal.

Fortunately the horns either provide calcium for millions of rodents or eventually rot into the ground.

The only species of deer which do not have horns are the musk deer and the little Chinese water deer. These two are equipped instead with long canine teeth, which they wield as mercilessly in their small battles as their cousins wield their antlers.

A few of the European and Asiatic deer wear handsome spots, but the rest of the tribe are clad in plain browns with various shadings. Given new coats twice a year, they have a heavy, warm attire for winter, and a light, cool one for summer. When it is time to change, they rip off the old apparel by degrees, tearing patches here and there on bushes and briers. At other times well dressed, they appear badly moth-eaten at the end of each season.

Deer are ordinarily vegetarians. Although they are supposed to confine themselves to browsing and grazing, they enjoy all the vitamins from A to D. When they come in contact with the ubiquitous traveler, I have watched them develop appetites for chewing gum, tobacco, oranges, cantaloupes, fried eggs, bacon, tapioca pudding, chocolate bars, ice cream, wrapping paper, and much other foreign matter.

Virginia, or Whitetail, deer (Plate VI), have been known to eat fish, and an elk has been seen gnawing a ham bone. Apparently, however, they draw the line at onions. I remember a deer which, when offered one of those tear-jerking vegetables, lifted his hoof, slapped the donor's wrist in sharp reproof, and walked away disdainfully.

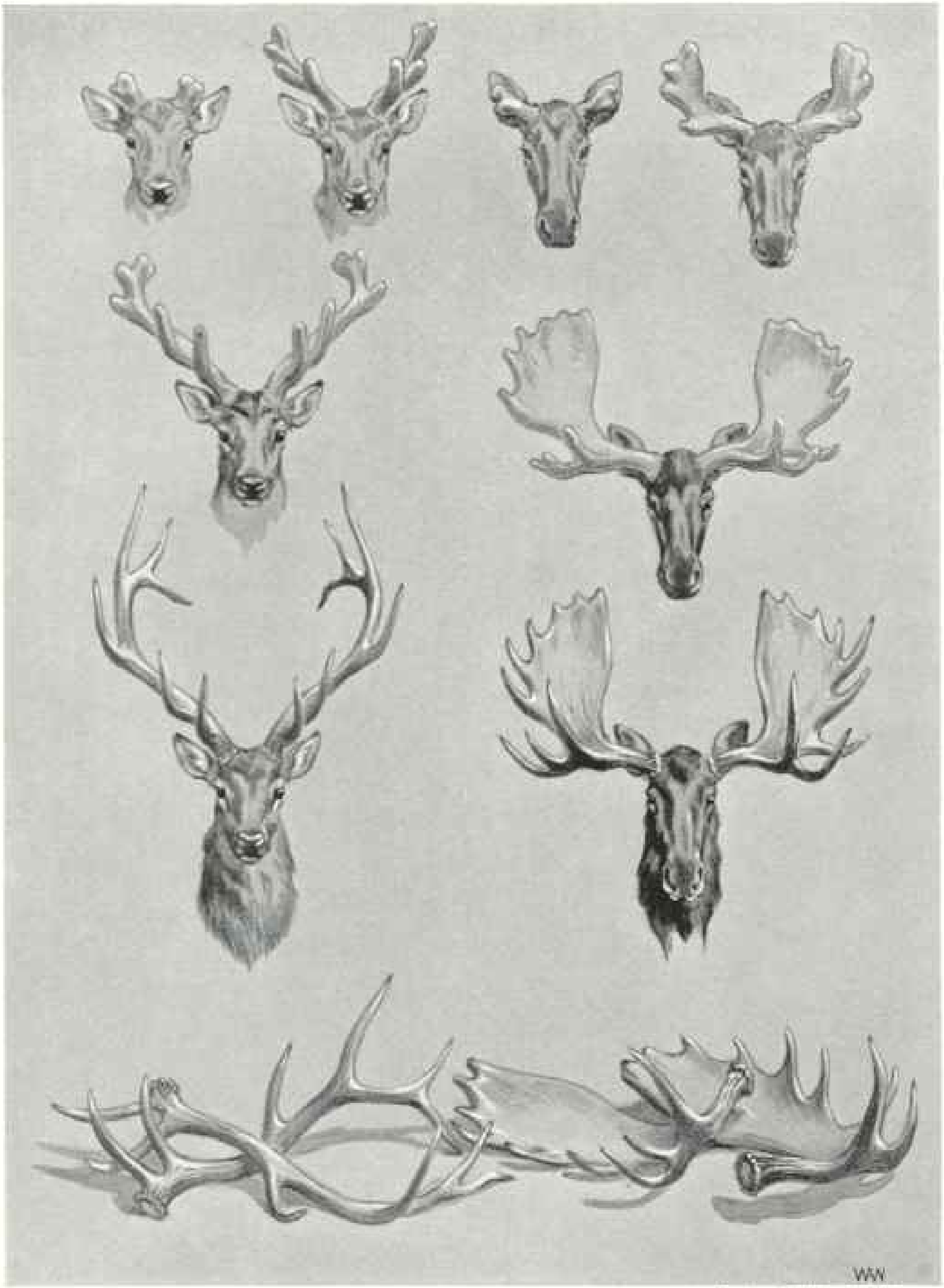
A BUCK COMPLAINS OF PICNIC FOOD

Since they are not usually loquacious, I was astonished upon coming out of my cabin in Sequoia one day to hear a buck complaining long and loudly. He could have been heard a hundred yards away. With short querulous bleats, he kept up a continuous lament as long as he remained within hearing distance. His distress was probably not caused by his emotions but by the state of his stomach. If he only had known it, a strong cathartic or abstinence from the vacationists' menus would have given him complete relief!

All deer must have salt. Large holes in saline clay are found licked smooth by their rough tongues. Imagine the joy of the deer which find this necessary item of diet rained like manna out of heaven. In vast game areas managers recently have dropped from airplanes, facetiously called "the flying salt cellars," blocks of salt for artificial licks.

Deer have a strong sense of curiosity and will frequently investigate any unusual motionless object. Hunters say the does are more inquisitive than the bucks.

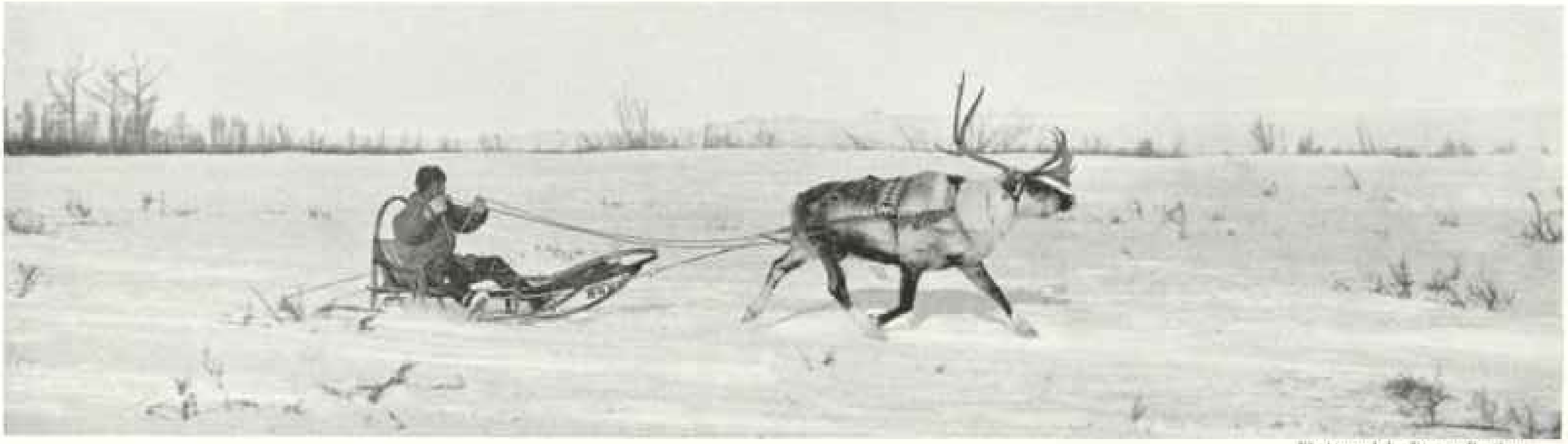
Usually forest and woodland creatures, most deer love the water. They are powerful swimmers and do not hesitate to dive under floating logs and other obstacles. The gregarious species of deer are often



Drawing by Walter A. Weber

ANTLER-OGRAPHIES OF THE BULL WAPITI (LEFT) AND MOOSE

The upper six sketches show growth from the simple budlike beginning in early spring through an intermediate to an advanced stage in the velvet. The velvet, a hairy, fleshy skin laced with blood vessels, carries nourishment and building calcium to the growing antlers. It takes about four months for them to attain full growth and two months to harden. In early fall, at the end of the hardening period, the bull rubs off the velvet against trees and branches. Each year, after the rutting season (time of mating), the antlers are shed,



Photograph by Lomen Brothers

SLED BELLS JINGLE AS A SWIFT AND POWERFUL REINDEER TROTTER RACES DOWN THE FROSTY HOMESTRETCH

The big deer, originally introduced to Alaska from Siberia, has greatly multiplied and furnishes transportation, food, and clothing to thousands of Eskimos.

Photograph by H. W. Terhune

HEADS UP, HAUNCHES IN, ANTLERS OUT IS GOOD FORM FOR CARIBOU SWIMMING THE UPPER YUKON RIVER IN ALASKA

Photograph from Wide World

AN ALBINO REINDEER TRAILS A HERD GUIDED BY "DEER-PUNCHERS" IN A BOAT PAST A CRUISE SHIP VISITING NORWAY'S COAST

Photograph by H. F. Mieleitz

HURRYING HOOFS PACK THE SNOWY DEER TRAIL AS STARTLED WHITETAILS DASH THROUGH WISCONSIN'S NICOLET NATIONAL FOREST

The bucks have already shed their antlers and therefore are indistinguishable from the does. Each deer was "stopped" by the camera in a different part of its stride.

© International News

BARNEGAT PETE "WHISPERS" SECRETS TO A BOY FRIEND

The pet deer "making up" to Byron Eno is well dressed in checkered blanket and flashy necklace, with his identification tag for a breastplate. He sleeps in a local store and romps with village children and dogs. During the hunting season, townspeople keep a close watch on his wanderings. Pete originally came to Barnegat, New Jersey, to escape a forest fire.

Photograph courtesy U. S. Department of the Interior

ONE HUNDRED PER CENT DEER APPEAL

Visitors to our national parks find it hard to resist such a shy, trustful, and wistful expression. Rangers and administrative officers continue to discourage offerings of bread, waffles, flapjacks, and similar tidbits, which are actually bad for the deer. More serious, however, is the fact that every year a great many well-meaning but thoughtless travelers are injured by flying hoofs or tossing antlers.

Photograph by S. N. Leak

REARING TO SLASH WITH THEIR FORELEGS, WAPITI BULLS STAGE A GRUDGE FIGHT

Most of this herd assembled in the Jackson Hole country of Wyoming shows no interest in the scrap. The wapiti is the most polygamous of American deer. If he is strong and skillful enough to fight off jealous rivals, a single bull may keep a harem of as many as 60 cows. Severe winters still take heavy toll of this American elk, because the animals have been dispossessed of their natural foothill and lowland range (page 483).

seen splashing one another and apparently playing water games.

On land they delight in a game of tag and "follow the leader." There is also a sort of dance in which some of them indulge. Keeping their noses close to the ground, the wapiti and moose trot with occasional galloping steps in circles sometimes 30 feet in diameter. The European roe has a courting dance in which the bucks pursue their ladies in circles.

Like white flags of distress, the upraised tails or hairs of the rumps of some species of deer fly among the trees, communicating alarm. Variously shaped according to their environmental needs, their feet often have scent glands that leave a message of warning as they race away from danger. Even a Scottish stag has been seen rapping his companion's shoulder with his forefoot to direct attention to an approaching enemy (page 473).

They have differently pitched cries for calling their mates, scolding their children, bugling a challenge to battle, bleating fright or pain, and snorting or whistling rage and disgust. These ejaculations are also made at times to frighten a possible enemy.

One still summer morning I was recording survey data on a forest-covered slope of Mount Toby in central Massachusetts. For a half hour I had been perfectly quiet except for my hand moving over my notebook. Down the hill just in front of me a stick snapped. I realized that something was slowly circling me. Nothing could be seen through the thick tangle of brush.

A DEER'S "BOO" IS STARTLING

Suddenly, without any warning, a piercing whistle sounded just behind me. It was the most hair-raising shriek that had ever been breathed down my neck. I practically jumped out of my shoes and turned just in time to see a whitetail leaping away through the tall brush.

Deer have trouble identifying motionless objects when there is no wind to carry scent. Probably she had been unable to tell what I was and had whistled to make me move. She succeeded!

Affectionate creatures, they often rub noses as if questioning and assuring each other of their mutual regard.

Although the mating season is in the fall, I have seen the white fallow deer apparently making love in the early spring. The creamy coats of the dainty, slender creatures change to a gleaming white and their ears to a soft translucent pink in the sunlight. Long, thick, white eyelashes fringe their dark eyes.

One of the stags I watched last year had a particularly beautiful antler spread. He bent gracefully over his lady, caressing her head, face, and throat. Occasionally he lifted his right foreleg and stroked her gently. She responded a little, but seemed more interested in observing the landscape.

The other does were restively jealous. They approached and tried to attract the stag's attention. Driving them off impatiently, he returned to his favorite, but she became bored with his demonstrations, arose, and moved languidly away.

Obviously discouraged by her inattention, he followed. When the watching does again attempted to beguile him, he ignored them. He consoled himself by talking it over with the other stag.

There seems to be no rivalry at this season. The two stags rubbed noses and shook their horns in agreement. "These females!" they seemed to say. Of course skeptics may observe that this was not a love scene but a grooming process.

The deer is a polygamous creature. One species may take only a single spouse at a time, but soon tire of her and rush off to acquire a new consort. Another, like the wapiti, will maintain a large harem during the mating season and stand ready to fight any male which attempts to steal one of his ten to sixty wives.

PREPARATION FOR BATTLE

Early in the fall, or in whatever season their rut begins, the stags free their horns of velvet, and sharpen and polish them for battle. The yearlings begin practicing the mighty war cry of their elders.

There are comparatively few fatalities, because most bucks feel that discretion is the better part of valor. The weaker males think twice before confronting their superiors. Even during the combat, a losing animal will often take to his heels at the first opportunity and the winner is satisfied to let him go.

Sometimes a deer will hang about a harem waiting for a bolder and stronger buck to challenge possession, hoping that he may acquire a doe or two while his betters are engaged in battle. A Wyoming elk was once seen driving a herd of 66. A lone bull followed, but did not dare to make a raid. One wonders why two or three do not join forces against the powerful possessor of such a large harem. Perhaps there are certain rules of the game.

It is not always the strongest that wins. Sometimes the quicker, more agile, or more clever sultan can keep the greater number of concubines. Even an abnormal stag without horns has been said to keep his hinds from all comers.

More of a wrestling match than a duel, the conflict is a grueling test of supremacy. Eyes bloodshot and neck swelling, the male plunges through the forest tossing his antlers and challenging his fellows to battle. Impatient for conquest, he slashes angrily at the trees and underbrush.

Upon encountering a rival, he lowers his head and charges. The contestants come together with a terrific crash. Antlers locked and heads down, they shove and push. Pawing frantically, they tear up the ground with their hoofs, trample bushes, and uproot small trees. They writhe and toss, the whites of their eyes rolling.

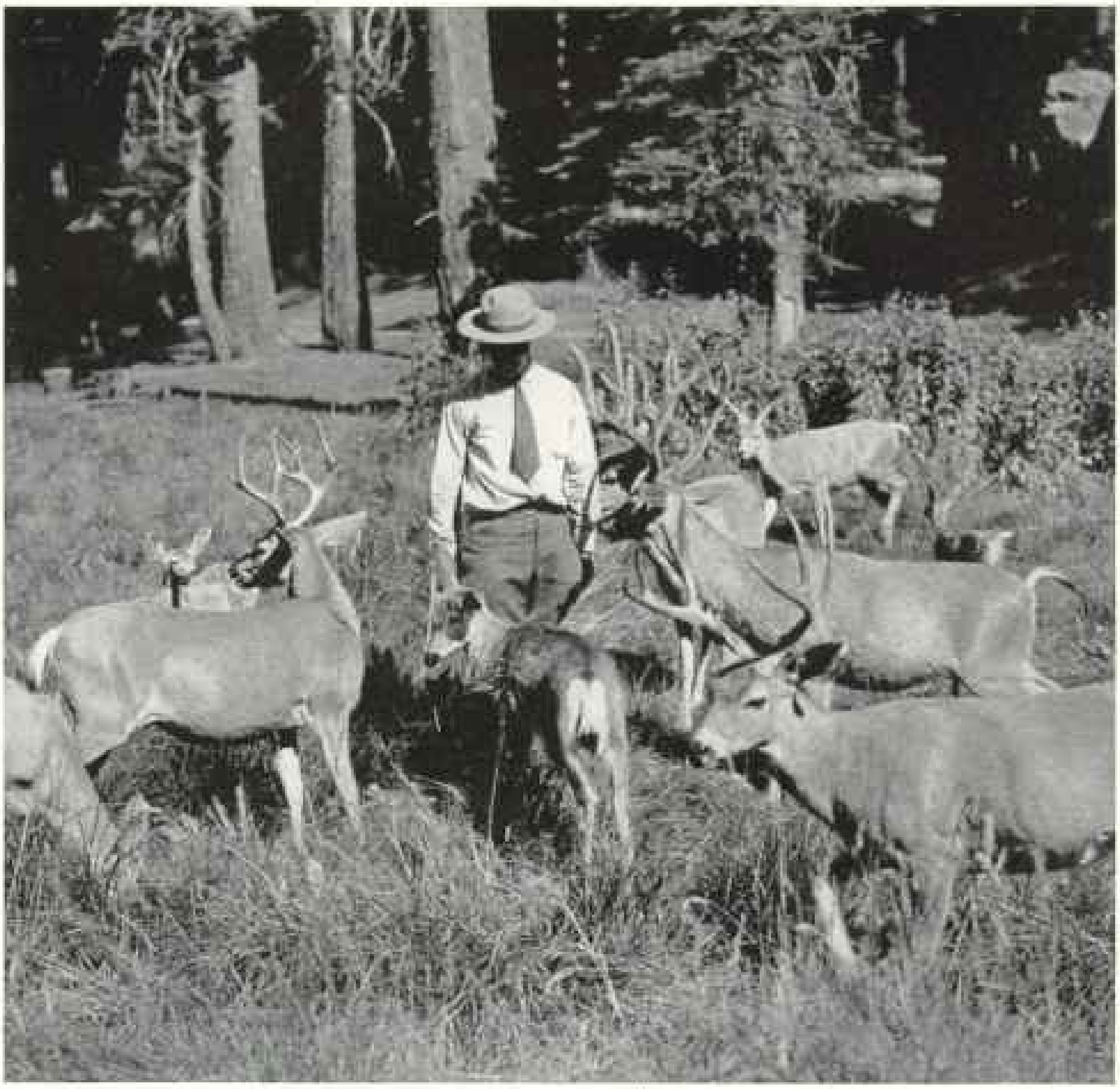
Again and again they break their lock and lunge at each other for stronger holds. Their muscles strain, their horns are wrenched, they puff and pant.

HORROR THE AFTERMATH OF VICTORY

If the losing stag does not take to flight, his antlers will be broken, or he will be brutally gored to death. Sometimes the horns become inextricably locked, and the combatants are grappled together in a hideous torture that means slow death to both (page 480).

The blood of three husky sportsmen ran cold when they saw the result of such a climax approach them a few years ago. Wearily and painfully a stricken buck dragged himself from tree to tree trying to feed himself. Locked in his battered horns, he carried the grisly head and antlers of his last opponent. Coyotes had devoured the body of the vanquished deer, but the winner had managed to kick them off.

The males eat little during the rutting period and are beaten, worn-out creatures at the end of the season. All rivalry ends,



Photograph courtesy U. S. Department of the Interior

A PARK RANGER MEETS WITH WOODLAND ARISTOCRACY IN A ROUND MEADOW CONFERENCE

California mule deer, curious like all the family, give their host the "once-over" in Sequoia National Park. Bucks in the foreground have scraped their antlers clean; those behind are still in the velvet.

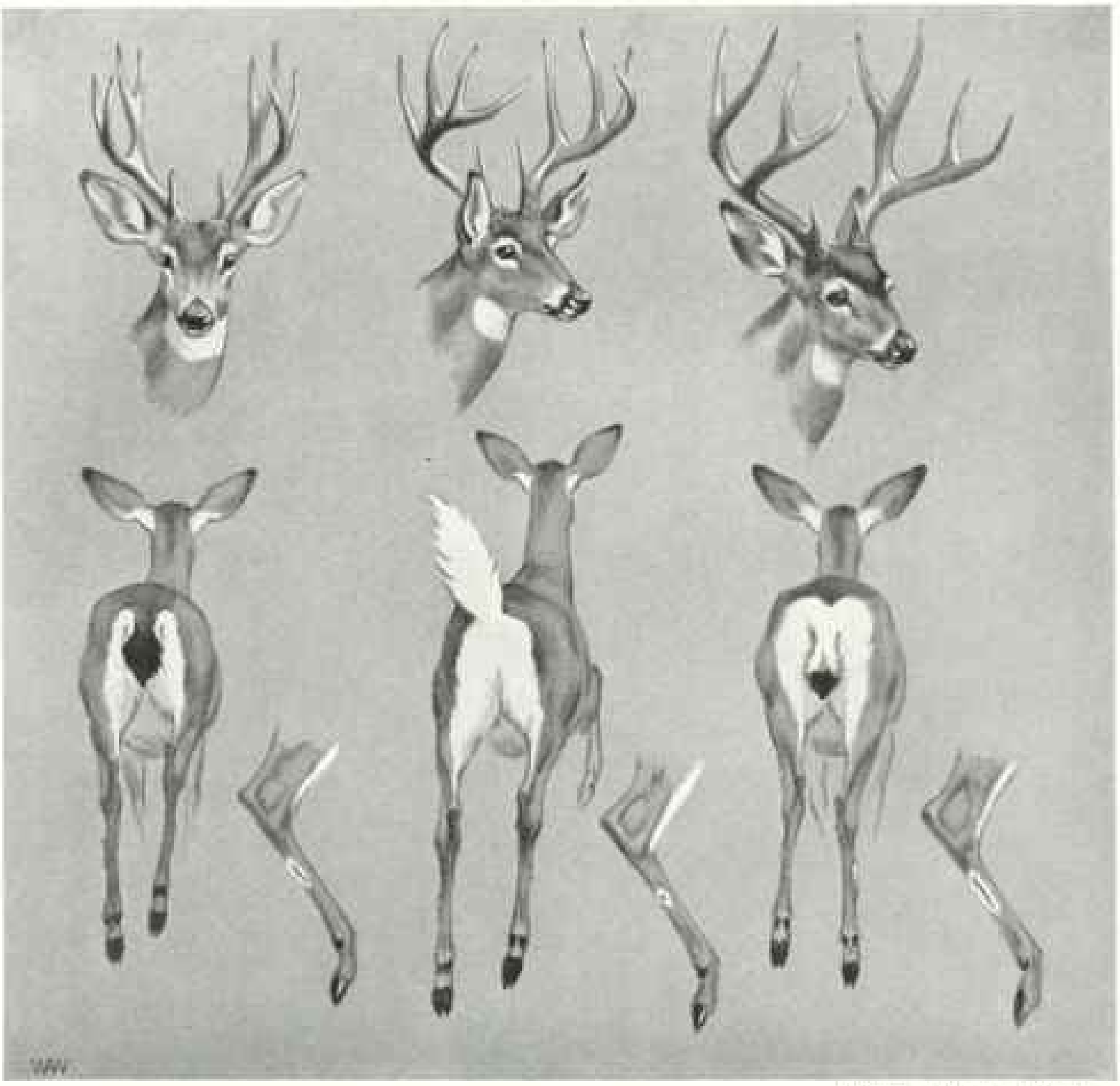
and grievances are forgotten. Those which live in herds often submit to a matriarchal system. Led by a wise old hind, and with other hinds for guards, they rest and restore their health for a new season.

Most prolific of all the species are the little Chinese water deer, which have four to six fawns in a litter (Plate XV). Other deer mothers give birth to one or two infants at a time and rarely triplets.

Generally the babies are spotted and do not have the strong odor of their parents to betray them. The doe hides them during the day, returning to nurse them, or, as they grow older, to take them abroad at night for food.

Until the offspring can understand his mother's orders, she pushes him with her nose or chin to make him lie down. If he is contrary-minded and needs discipline, she administers a hasty wallop that brings immediate obedience. He soon learns to drop in his tracks and stay motionless at the first sign of danger. Although fawns are usually well hidden, I once found a little one lying flat in the wheel ruts of a road, blissfully unaware how conspicuous he was.

Unlike bears, which are interested in no children but their own, deer mothers sometimes adopt the orphans. A few years ago, an elk was seen flying up a steep hill leading



Drawing by Walter A. Weber

FORE AND AFT, THEY CARRY THE FEATURES BY WHICH THEY ARE KNOWN

The artist has drawn antlers, tails, and hind legs of three species of American deer. Bifurcated antlers and a tail black above and held straight out behind in running characterize the Columbia blacktail deer (left). The Virginia, or whitetail, deer (center) carries antlers with dominating main beams from which the unbranched tines rise vertically. The large tail is pure white underneath and held high as its owner bounds along. Resembling the blacktail, but with distinctly larger and more widely spreading antlers, the mule deer (right) bears a black horseshoe-shaped patch on the forehead. Its tail is white with a black tip and is held down in running. On the side of each hind leg appears the leg gland (metatarsal gland)—about three inches long for the blacktail, one inch in the whitetail, and approximately four inches long for the mule deer.

four calves. Deep snow held the youngsters back, and finally they could scarcely make headway.

HEROISM OF A COW ELK

Looking back, the elk saw their predicament and realized that they would never be able to make an escape. In spite of the danger to herself, she retraced her steps and, pushing the youngsters with her forefeet, forced them to turn back and take a less difficult route.

The "good neighbor policy" does not always apply to deer, however. In the mountains of Arizona, I once watched a group of does and their fawns. One of the cocky youngsters tired of his mother's brand of milk and began to look around for new horizons. Making a cautious tour, he watched the gustatory delights of his playmates with envy. At last he got up enough courage to edge experimentally up to his best friend's mother. With a swift, well-placed kick, she sent him flying into the

Photograph by Ben East

MOTHER MOOSE BACKS UP HER CALF AS THEY COME ASHORE AFTER A LONG SWIM

When weary, the youngster may cling to the maternal rear. This scene was snapped at Lake Richie, on Lake Superior's Isle Royale.

Photograph by Frank W. Childs

PLAYFUL SPARRING BETWEEN MOOSE MAY BE ONLY PRELIMINARY TO A VICIOUS COMBAT IN WHICH ANTLERS SPLINTER AND FUR FLIES

ONE OF THE MASTERPIECES WITH WHICH GEORGE SHIRAS, 3D, FIRST DREW ATTENTION TO THE ART OF ANIMAL PHOTOGRAPHY AT NIGHT

This picture of a doe and her twin fawns feeding on a lake in Michigan was exhibited with nine others by the United States Government at the Paris Exposition. The group received the Gold Medal. At the World's Fair in St. Louis it won the Grand Prize.

Photograph by Fred Armbruster

NICE WORK—IF YOU CAN GET AWAY WITH IT!

In Banff National Park, Canada, a forest lord licks up a food offering from a man's cupped hands. Moose frequently attack humans, often without apparent provocation. Small new antlers in the velvet give no hint of the massive many-pointed palms they will grow to be.

bushes. He bleated a sharp cry of surprise and humiliation, scrambled back to his mother, and thereafter stayed at home.

Bears have been known to kill small fawns, and mother deer will not tolerate their presence knowingly. A ranger in Yellowstone National Park once told me about a mother elk which charged furiously into the woods one day, her ears laid back and the hairs of her ruff standing upright. Hastily scrambling up a tree, a black bear narrowly dodged her. Snorting with anger, she went back to feeding with her baby.

As they browsed farther and farther away, the bear decided that it was safe to descend. He got cautiously to the ground and tried to sneak off. But the elk had seen him. With a rush she was almost upon him, striking angrily. Bruin climbed back up the nearest tree, his tongue hanging out in the efforts of his hasty ascent. The elk shook her head warningly and returned to her repast, casting an occasional malignant eye on the prisoner.

The minutes went by, and the bear made another attempt to escape. As he started to clamber down the trunk, the elk turned and with a look sent him hurriedly back to the branches. The bear made several further attempts to get away as the afternoon wore on, but never achieved more than a few feet of progress until the elk wearied of feeding and ambled off with her child. Any man who has been chased by a bear would have relished watching this rascal being treed by an elk.

Always suspicious of human beings, a mother moose became very angry when she discovered another ranger in Yellowstone National Park attempting to extract her calf from a deep quagmire. She rushed forward, charged the ranger up a tree, and proceeded to rescue the child herself. Snorting angrily at both man and offspring, she stalked off.

RARE THE BUCK THAT KNOWS HIS SON

Except for the roe buck, most male deer never recognize their own offspring. Even gregarious bucks which herd with the does and fawns show no concern for the young, but let them shift for themselves or run to their mothers.

Toward the end of a long, hard winter in Yosemite, several mule deer does must have been greatly surprised when one of

their mates displayed an uncustomary interest in the performance of parental duty. A hungry coyote had been slinking about the edge of the herd apparently trying to pick off one of the weakened fawns. Desperately worried, the deer mothers ganged up on this marauder. They circled around him, and finally trampled him to death. When the killing was over, a handsome buck appeared. With a lordly gesture of finishing a noble deed, he ostentatiously tossed the mangled corpse over his antlers.

There are perhaps other exceptions to this general indifference of the stag. A fawn being pursued by a coyote was recently seen running to a lake, bleating with terror. He plunged into the water and began swimming toward the opposite shore. The coyote, which has an atavistic dislike for water, sped around the lake and reached the other side just as the breathless little fawn arrived.

A buck had been watching the chase. Whether some paternal spark was struck or whether he was in a mood for fight, he charged the coyote with lowered antlers. Immediately losing his appetite for fresh meat, the coyote beat a hasty retreat to the hills.

Deer all over the world have their four-footed enemies: wolves, coyotes and other dogs, members of the cat family (tiger, puma, and jaguar), and several kinds of bears.

In Europe and North America, south of the Northern Plains, or Barren Grounds, their greatest enemy has been, outstandingly, man. With the rise of population in Europe, beginning about the time of Charlemagne, the forests were cut down and fields cleared for tillage. Wild life was not only killed off faster than it could reproduce, but its home was destroyed. A similar story was repeated in the settlement of North America. Deer and elk were killed by the hundreds of thousands, many for their hides alone, many for the sheer lust of killing.

PESTS, NOT HUNGER, KILLED DEER

Deer are subject to diseases and numerous internal and external parasites. Pneumonia, certain trypanosomes, ailments transmitted by domestic stock (hoof-and-mouth disease, scours, rinderpest, anthrax), lungworms, liver flukes, intestinal worms, nose fly larvae, bots, ticks, fleas, lice, and biting flies are some of the afflictions for which they have no remedy but time.

When I was mammalogist for Michigan several years ago, a great disturbance was raised throughout the State by indignant sportsmen. It was late winter. Snow was still on the ground. Hundreds of deer were dying. The Department of Conservation was accused of parsimony and failure of duty.

"Deer Starving to Death!" "Deer Must Be Fed!" "Put the Deer on the Dole!" "Michigan Deer Facing Extinction!" shouted headlines over news stories from hunters and humane societies.

Upon investigation I found that the dead deer, though emaciated, had full stomachs. They had died of pneumonia, cold, and exposure.

The following summer I found an outstanding cause of their weakness and susceptibility. The nose of every deer that I examined in that part of Michigan was nearly plugged with nose fly larvae. Flies of the genus *Cephenomyia* had laid their eggs in the deer's nostrils. The eggs hatched. With little hooks bestowed by a paradoxical Nature, they clung fast. However hard the deer tried, they couldn't sneeze the tormentors out. The parasites burrowed deep, constantly sucking blood and growing fat. When mature, they left their bed and board without farewell or thank-you and dropped into the ground to pupate. Their unwilling hosts, weakened by loss of blood, faced with an almost overwhelming handicap the adversities of life and more flies.

The life expectancies of these deer range from three to fifteen years, or possibly longer, according to the species. Even if they survive disease and their enemies' attacks, their precarious lives are made up of one accident after another.

Like humans, they can make a fatal slip in their bathtubs. Many a moose has skidded and bogged down in a lily pond, never to rise again. Three yearling elk, pursued by a mountain lion, once leaped into a hot spring in Yellowstone National Park. Unable to move their feet, they sank, and, standing upright, were drowned, and slowly and horribly cooked.

Deer of the northern countries break through the ice and, unable to climb back, are drowned and frozen as the ice thickens. Snowslides may trap or cover them. All over the world they leap from cliffs in terror-stricken fright, impale themselves on sticks or sharp branches. One monarch was

found pinned to the ground when a falling tree had caught his antlers. Starvation and predators slowly and ruthlessly ended his life.

"MUSIC HATH CHARMS"

Occasionally deer have been hunted with a violin. Perhaps they have an ear for music! In Europe, hunters have attempted to lure the animals to within shooting range by hiring a violinist to kneel in the bushes and play his instrument. (One wonders whether Debussy might be more successful than Chopin!) A moose in Sweden became so enraged by the playing that he charged into the blind and killed both hunter and musician.

An American photographer was much more successful. The moose, annoyed at being posed, lowered her head and made every motion of charging. The photographer bravely whistled and the moose stopped stock-still. Apparently enchanted, the animal relaxed and seemed to assume an air of pleasantly critical audition.

The photographer continued his repertoire and edged himself up into a tree—just to be on the safe side. In his excitement, however, he dropped his camera. Not impressed sufficiently by the musical performance, the moose refused to let the whistler come down to retrieve his loss, but kept him treed as long as she desired to feed in the neighborhood.

Campers have observed that elk apparently enjoy radio music, but show their disdain for man's mind by refusing to listen to his speeches.

Since the fifth century reindeer have been domesticated.

ESCAPING CRIMINALS USED REINDEER

When Charles IX ruled over Sweden, European elk (closely related to our own moose) were tamed and trained to carry couriers many leagues a day. Because of the great speed of these animals, numerous criminals escaped and it became necessary to declare transportation by means of elk illegal in the 17th century.

Throughout the ages deer have been hunted. Prehistoric man ate their flesh, warmed himself in their hides, made ropes from their tendons, harpoons and hammer heads from their antlers. During the mid-Neolithic period the horns were used as picks to shaft-mine flint and later for handles of less primitive weapons and tools.

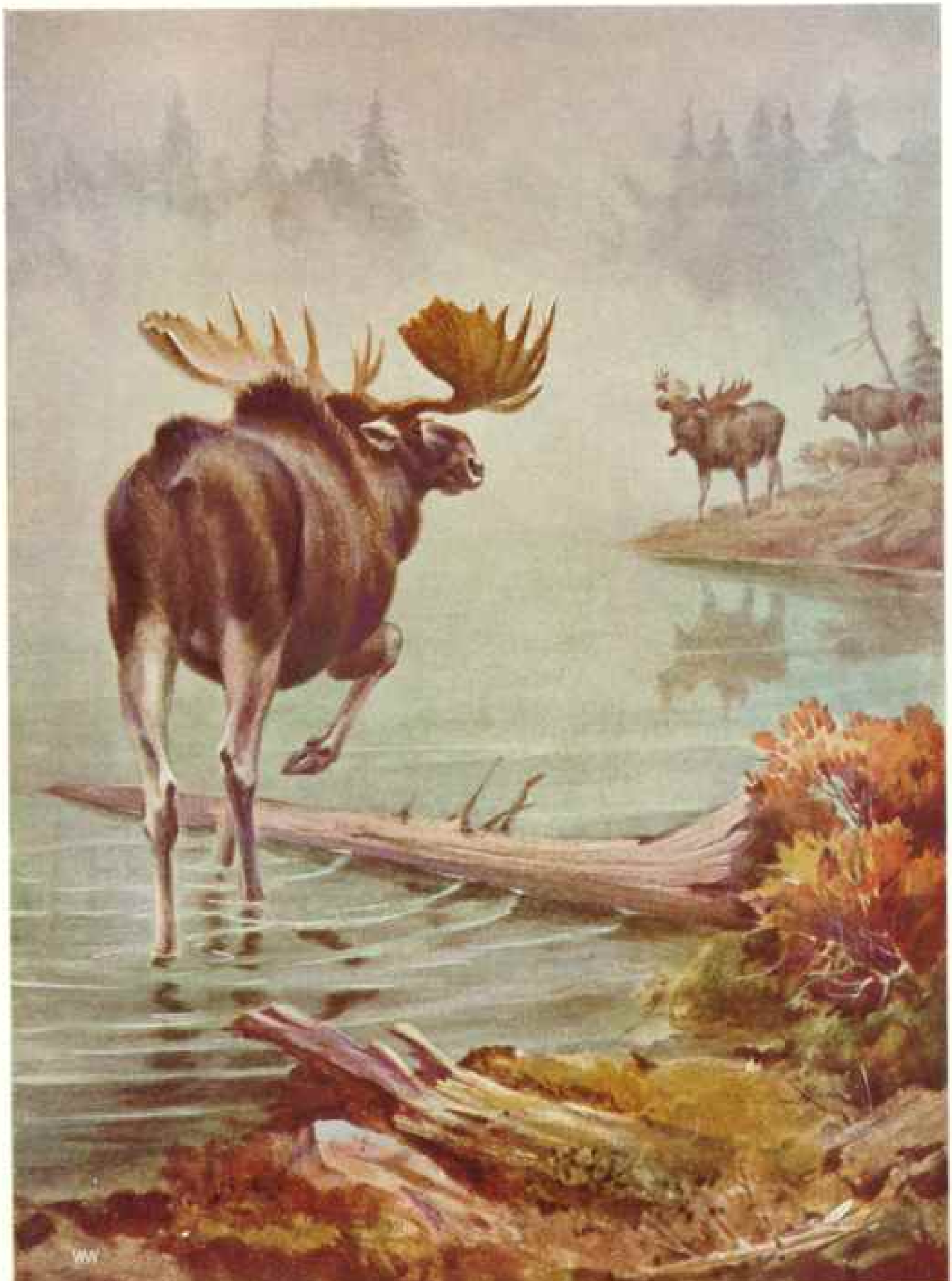
In medieval battles, fighters were equipped with slings of European elkskin for hurling stones and other missiles. Later the skins of elk legs were ripped off carefully to provide gun sheaths and powder pouches. Elkskin jackets, being tough and heavy, were at first believed to be bullet-proof. People of eastern Siberia sent tribute of thousands of elkskins to the Chinese, and Russia paid war indemnity to Austria in many hundred wagonloads of skins. The elk in Poland are assumed to have been exterminated because Paul I, Tsar of Russia, ordered his cavalry equipped with elkskin breeches.

The thick coarse hair of the European elk, musk deer, and others have filled many cushions and padded many saddles. Their fat is still rendered into grease and candles. Hides of deer all over the world are in continuous demand for fine leathers. Implement and umbrella handles, furniture, chandeliers, decorations, glue and cloth sizing are manufactured from their antlers. An additional and great source of revenue is the sale of hunting licenses.

Many ancient "remedies" were made from the European elk, musk deer, and others. They ranked as high as patent nostrums in the United States today, but most of them were worse than useless. At that time a doctor could supply his entire practice from the proceeds of one animal.

The left hind foot removed from a living elk was believed to be a cure for epilepsy if part of it were worn about the sufferer's body, ground up in wine and imbibed, or burned and inhaled. The antlers would do almost as well if they were taken the first of September. If obtained at an earlier date while still growing and at a tender stage, the horns were sliced and steeped with herbs and spirits for treatment of snake bites. The animal's fat made an efficacious ointment, and his heart when ground or burned was considered a sure cure for heart troubles. The approved treatment for arthritis, rheumatism, and cramps was dried nerves wrapped about the afflicted limbs. This was supposed not only to cure, but, if worn continuously, to prevent further attacks!

The musk deer is still in great demand by the Chinese for the manufacture of medicine, and in April, 1939, its musk was used in one of the New York hospitals for a persistent form of hiccoughs.



Painting by Walter A. Weber

ACROSS A MISTY LAKE, AN ALASKAN BULL MOOSE CHALLENGES A RIVAL.

This lordly animal is closely related to the common moose, which patrols the northern wilderness from Maine and Nova Scotia to the Arctic Northwest. During the mating season in autumn, forests echo with the clash of broad, palmated antlers as powerful bulls battle for the cows. Twenty-seven deer from many parts of the world are presented in this series painted specially for the NATIONAL GEOGRAPHIC MAGAZINE by Walter A. Weber.

INTERLOCKED ANTLERS TELL A TALE OF RIVALS' DEATH

Mr. George Shiras, 3d, holds two 50-inch pairs of moose antlers which he found at St. Ignace Island, Lake Superior. During a mating season battle, the animals literally "locked horns" and could not pull apart. Death soon vanquished both (page 471).

Alaska Moose

Alces gigas

Awkward and grotesque in appearance, the moose are the largest and most powerful deer in the world. These huge, heavily coated creatures inhabit the cold northern lands all the way around the Pole. On this continent moose are found throughout much of Canada south and west of Hudson Bay, in Alaska south of the Arctic Circle, on the northern fringe of the United States from Maine to North Dakota, and south in the Rockies to west-central Wyoming. In the Old World, elk (European moose) range from northern Norway and Sweden eastward through Siberia above latitude 50° to Amurland, with a few in East Prussia and Livonia.

Of the species of moose that inhabit this vast stretch of two continents, the greatest of all is the Alaska (Plate I). Weighing sometimes almost a ton, he reaches the tremendous height at the shoulders of 92 inches—nearly eight feet! Towering beyond his massive head are the heavy palmated antlers that may spread six feet more.

Neither beautiful nor graceful with his heavy, overhanging muzzle, long legs, thickset body and hunched shoulders, this dark, ponderous giant has a certain magnificence of size and force as he trots effortlessly over alder swamps and crashes through windfalls of the northern forests. However, despite his long legs, he customarily passes his life in one permanent home, confined to a radius of ten miles.

During the rut when the cow calls invitingly and the bull rushes about madly, he takes several mates, but keeps only one at a time. In this season hunters frequently decoy the bull into rifle range by imitating the low blatting love call of the cow.

Having torn up the ground and broken down trees in titanic battles for his wives, he often meekly settles down for the winter with one of his consorts, docilely tolerates a stepson or two, and presents a picture of exemplary domesticity.

Moose calves, generally twins, are born in May and are reddish brown without spots. They stay with their mother until she drives them off the following spring,

just before the arrival of her new babies.

Smaller deer must often stand on their hind legs and reach into the high branches with their forefeet for their meals. The long-legged moose does not have that difficulty, but is annoyed by the necessity of reaching down six feet to a dinner table of grasses. He has been seen to rest himself by kneeling and hunching along to feed. He is fond of leaves, shoots, and twigs of hardwood trees and balsam, and is often seen reaching below the water or diving for water lilies and other aquatic plants. During the summer months he swims for miles in cold spring-fed lakes. Even a young calf will attempt a long water trip. If he gets tired, he will grab hold of the rear of his mother and hang on for dear life.

Reindeer

Rangifer tarandus

Wearing fur coats that act as air cushions on the water, and outfitted with SOS signals, snowshoes, and skates, the Old World reindeer and American caribou are equipped to travel a hundred miles a day (Plate II). Built on a warm foundation of thick fat, the hair of their coats gives extra warmth without extra weight, waterproofing them, providing buoyancy to hold them high in the water, and giving them a faster swimming speed than any other deer. The raised white tail and surrounding patches of white act as signals of alarm.

In a land of deep snow, the hoofs and slender legs of an ordinary deer would sink helplessly. Reindeer and caribou, however, have hoofs which cut the ice like skates, and which are large enough to act as snowshoes. Greatly developed false hoofs, or dewclaws, located low on the "fetlocks," are of further assistance.

THE MYSTERY OF THE SOUND REINDEER MAKE ON THE HOOF

When walking or running, the Old and New World reindeer produce a clicking sound, so loud that it can be heard a hundred feet away. Some zoologists believe that when the 300-pound weight of the animal is released as a stride is begun, the spread "claws" of the hoof "click" together. The other school insists that the sound is produced as the weight settles down on the foot, not when it is removed, and that the sound therefore comes from knuckle-cracking movements of the bones within.

Reindeer thrive under conditions and on fare that would quickly exterminate less hardy animals. The only deer to have warmly covered muzzles, they paw and nose through the snow for lichens and mosses when the low wind-flattened shrubs are no longer available.

The sole females of the deer family to have equal rights and standard equipment of antlers are the reindeer and caribou. They keep them longer than the bucks, until about the time the babies are born in May or June—when they abandon all vanities and concentrate on motherhood. As a matter of fact, they need these horns in the terrific competition for food during the winter months. The snow is often too hard for them to penetrate and they must use their antlers to push aside the stronger, unchivalrous males which are able to uncover plenty of food.

For the Lapps and other inhabitants of northern Norway, Sweden, Finland, Russia, Siberia, and of Spitsbergen and other large Arctic islands, reindeer are the chief wealth and the staff of life. Without reward of food or shelter, they provide tireless transportation and milk. One calving female yields daily about three cups of milk, which is drunk, cooked, or made into cheese and butter. Since there is no maintenance except herding, even a poor Lapp can afford a fair-sized herd. When killed, the animals furnish meat, clothing, and many other necessities of life.

Covered with soft gray coats that are almost white in winter, reindeer stand 42 inches high and weigh 300 pounds. They are caught when wild by the use of a trained male or female as decoy. Both adults and fawns are marked by cutting or biting out ear notches, and then trained into semidomesticity. Not kept under cover or within fences, they wander about, feeding themselves. If the owner wants a pint of milk or a ride, he goes out to the tundra and lassoes one of the animals.

If lonely and desiring to visit another, the Laplander harnesses a deer to his boatlike sleigh by means of traces fastened to a belt around the animal's neck, and goes merrily off through the dancing ice crystals at nine or ten miles an hour.

In the early 16th century, when long-distance travel by reindeer was a serious business, a traveler had his hands full. Tied by his feet in a boat-shaped carriage so that he would not fall out (and praying that the conveyance would not overturn), he held the reins in one hand and a guiding staff in the other. After a certain number of miles, the reindeer was let loose to return to his owner and a fresh deer was yoked to the sledge.

For impoverished Eskimos reindeer were introduced into Alaska, where they became locally overabundant. As the Alaskan Eskimos waxed fat on their new reindeer industry, the food supplies of the Canadian Eskimos dwindled to almost nothing. On Christmas Day, 1929, ten men set out to drive 3,000 reindeer north and east from western Alaska on the Arctic Circle to Canada's coast on the Arctic Ocean. After nearly four and a half years of almost superhuman efforts and incredible hardships, they reached their destination. Only 10 per cent of the original herd had survived, but five fawnings had helped to replace the dead. It was a colossal undertaking, of too great a magnitude to have been tried before or likely to be attempted again.

Painting by Walter A. Weber

A NOMAD LAPP HITCHES HONDER AND BLITZEN TO HIS BOATLIKE SLEDGE

Staff of life to thousands of northland dwellers in Europe is the domesticated **Reindeer.** Vast herds descended from introductions now roam Alaska and Arctic Canada to serve the Eskimo. Several dig with hoofs and noses for grass, mosses, and lichens beneath the snow (background).

Painting by Walter A. Weber

AS CARIBOU RACE FOR COVER, AN INDIAN HUNTER'S ARROW FINDS THE HEART OF A SPLENDID BUCK

Caribou are the reindeer of North America. There are two main groups: the **Woodland Caribou** (shown here), and the smaller gray Barren-Ground type, with longer, but more slender, antlers. Original range included most of Canada and Alaska. The Woodland species is fast diminishing; while the Barren-Ground is still relatively abundant in some regions. Not so swift in a sprint as moose or whitetail deer, the caribou migrates over far greater distances.

Photograph by Frank W. Childs

BULL ELK ENJOY HOT-WATER HEATING IN THEIR WINTER HIDEAWAY

Splendidly crowned with full-grown antlers, two male wapiti, a doe (head hidden by snow bank), and a fawn (head just visible) in Yellowstone National Park stand in a brook fed by warm springs. Eight-foot-high walls of deeply drifted snow cut off cold winds. For food, there is dry grass clinging to the stream banks.

Woodland Caribou

Rangifer caribou

The North American caribou, the reindeer of the New World, are found over Alaska, most of Canada (except southern Ontario, Saskatchewan, and Alberta) and on the larger islands of the Arctic Ocean and the coast of Greenland. The small, pale species north of latitude 60° are called Barren-Ground caribou (*Rangifer arcticus*); the large dark ones of the Rockies are aptly termed mountain caribou (*Rangifer montanus*); and the southern and eastern forest dwellers are the woodland caribou (Plate III).

A few of the mountain form still range in the wilderness of eastern Washington and perhaps in northern Idaho. Woodland caribou once lived in Maine, northern New Hampshire and Vermont, northern Michigan and Minnesota; but these were exterminated years ago except for a dozen or so in the Quetico-Superior lake country of Ontario and northern Minnesota.

Perhaps because of the abundance of moss and lichens, the woodland caribou are much larger than the reindeer. With the exception of the white Newfoundland species, they are also much darker in color. Trimmed with heavy, yellowish-white manes, their dull grayish-brown winter coats become a deeper brown in summer. Although six inches taller than the reindeer, they are less chunky. The bucks weigh only 200 to 300 pounds and the does about fifty or sixty pounds less.

In early October the caribou mate and scat-

ter over the country, two or three cows with a bull. Soon they gather into larger bands of five to twenty. Through the long winter they wander along the desolate hardwood ridges, descending into the tamarack and cedar swamps to avoid the coldest winds or heavy snow. By June the bands have again broken up into ones, twos, or threes, and the does fawn in solitude. The single youngster is colored much like his mother, with faint indications of white spots. Unlike most fawns, he is never hidden, but precociously follows her over the tundra a few hours after his birth.

Caribou are much wilder than reindeer. Any one region is seldom home for long to these species of the New World. They are probably the most migratory of all the deer, drifting like ghosts through the snowy forests or wandering over the scrub-covered tundra, urged on by mysterious vagaries. Their difficulty of comprehending new dangers, such as the white man's firearms, may some day spell their doom. The once vast herds are already greatly reduced.

Some time in July, for two weeks or so, many thousands of these mysterious creatures journey through Mount McKinley National Park, Alaska. Even from the motor road the visitor may see the continuous procession moving in groups, bands, and herds, a kaleidoscopic scene. Individual animals stop occasionally to feed, then hurry on, all going in the same general direction, endlessly pushing on from somewhere to an equally indefinite nowhere.

Wapiti

Cervus canadensis

Many years ago, when the early English colonists first penetrated the forests in America, they found a new deer, a magnificent animal larger than their own "stag" or red deer, but closely resembling it. The Shawnee Indians called it the *wapiti*, but, disregarding the fact that a hump-shouldered, broad-antlered animal of northern Europe already bore the name, the English called it the "elk," and the name has stuck (Plate IV).

Uprooted from practically its entire range, the wapiti have remained only in the Rockies, over a large segment of Saskatchewan and Manitoba and along the Pacific coast of northern California, Oregon, Washington, and British Columbia. Comparatively small numbers have been restored in Pennsylvania, Virginia, Michigan, South Dakota, and New Mexico.

Even in the rugged wilds of the Rockies the white man has encroached on the wapiti's range. Winter is a lean period for most kinds of wild animals; of them all, perhaps the wapiti fare worst. They have been dispossessed of most of their winter range—the valley bottoms and foothill country where the snowfall is light enough for them to reach the cured grasses beneath. Man has settled these places, fenced the fields, and either overstocked the land with cattle or harvested the hay for his own animals. The wapiti are therefore caught between the two millstones of the high mountains, where food is locked in winter's grasp, and the unfriendly, pre-empted valleys.

Many thousands of wapiti have starved to death in recent decades, or have been slaughtered like sheep in natural migration lanes that continue to be used in desperation and necessity. A few attempts to remedy this bad situation have been successful. One of the best known is the winter Elk Refuge of the Biological Survey in Jackson Hole where the southern Yellowstone herd finds food and safety on former farmlands. Other winter range should be provided, however, for the high ranges of the West can support many wapiti at the proper season.

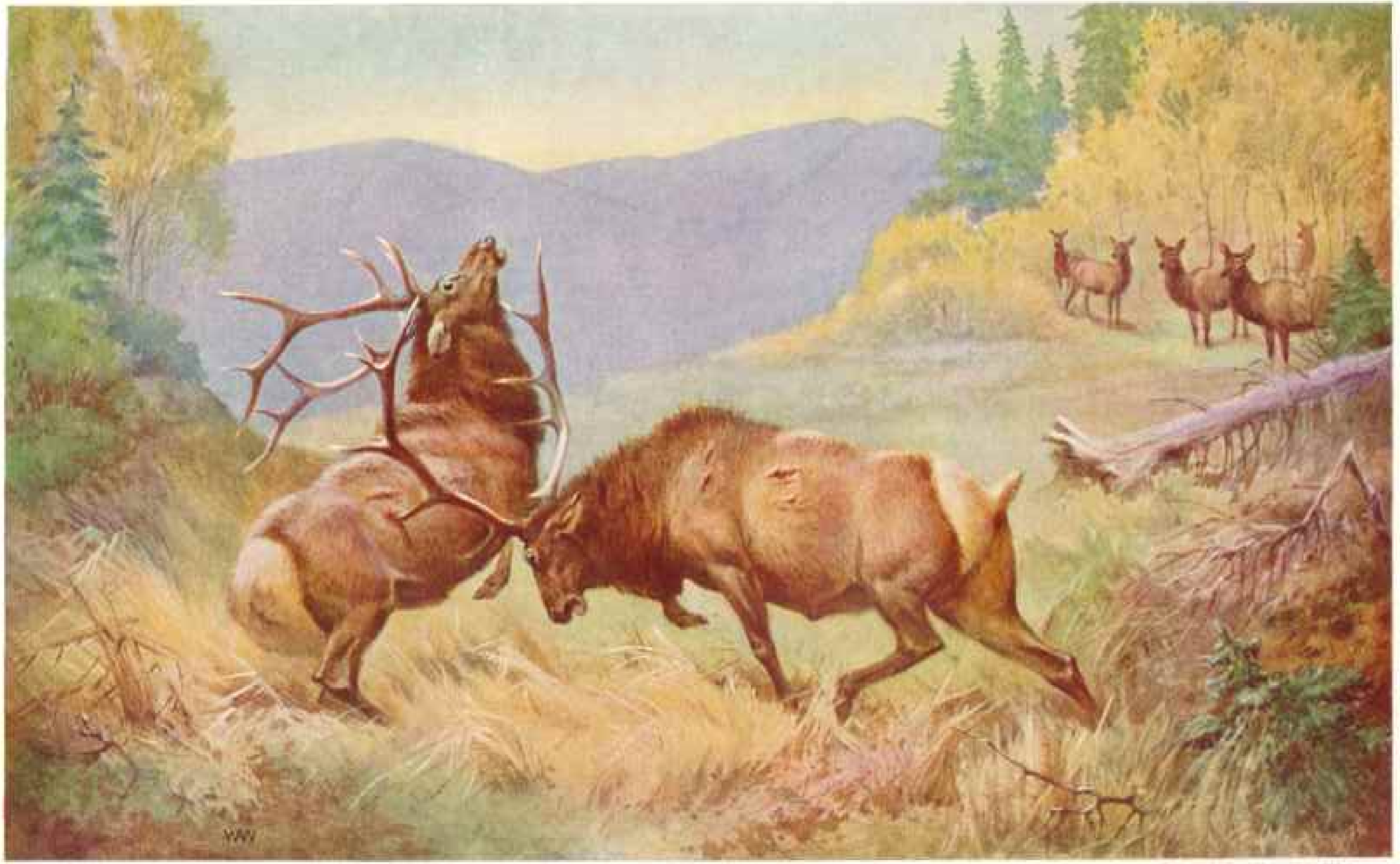
Most polygamous of all American deer, and perhaps of the world, is the wapiti, or "elk." Bugling through the forests during the mating season, he keeps an eye out for additional likely young cows and his ears back for a marauding bull. Of course the strongest and cleverest bull is able to keep the largest harem, sometimes as many as sixty or more cows. The young and old must take what is left. Many a young bull has been seen to hustle his little band of wives off over the hill out of sight at sound of the roar of a mightier bull.

Born in early June, the enterprising little spotted calf begins to follow his mother when he is only three or four days old. One can scarcely believe that some day he will weigh 700 or possibly even 1,000 pounds. Standing about five feet at the shoulders, he will brandish magnificent antlers that may spread a maximum of another five feet. Coated in brownish gray, with dark brown on his legs, head, and maned neck, he will wear a short straw-colored tail over a straw-colored rump patch.

Although he grows up to be a vast-bodied, serious-minded creature, he may still have his lighter moments. Wapiti which are not too old to be overdignified or grumpy have often been seen playing tag and splashing one another in the water. On rare occasions they also indulge in the "circle dance."

Travelers in automobiles have imprudently chased a wapiti on a national park roadway to determine his speed. They have reported a maximum of 35 miles an hour for a short distance. It is fortunate that the animal kept to his heels and did not attempt to charge them.

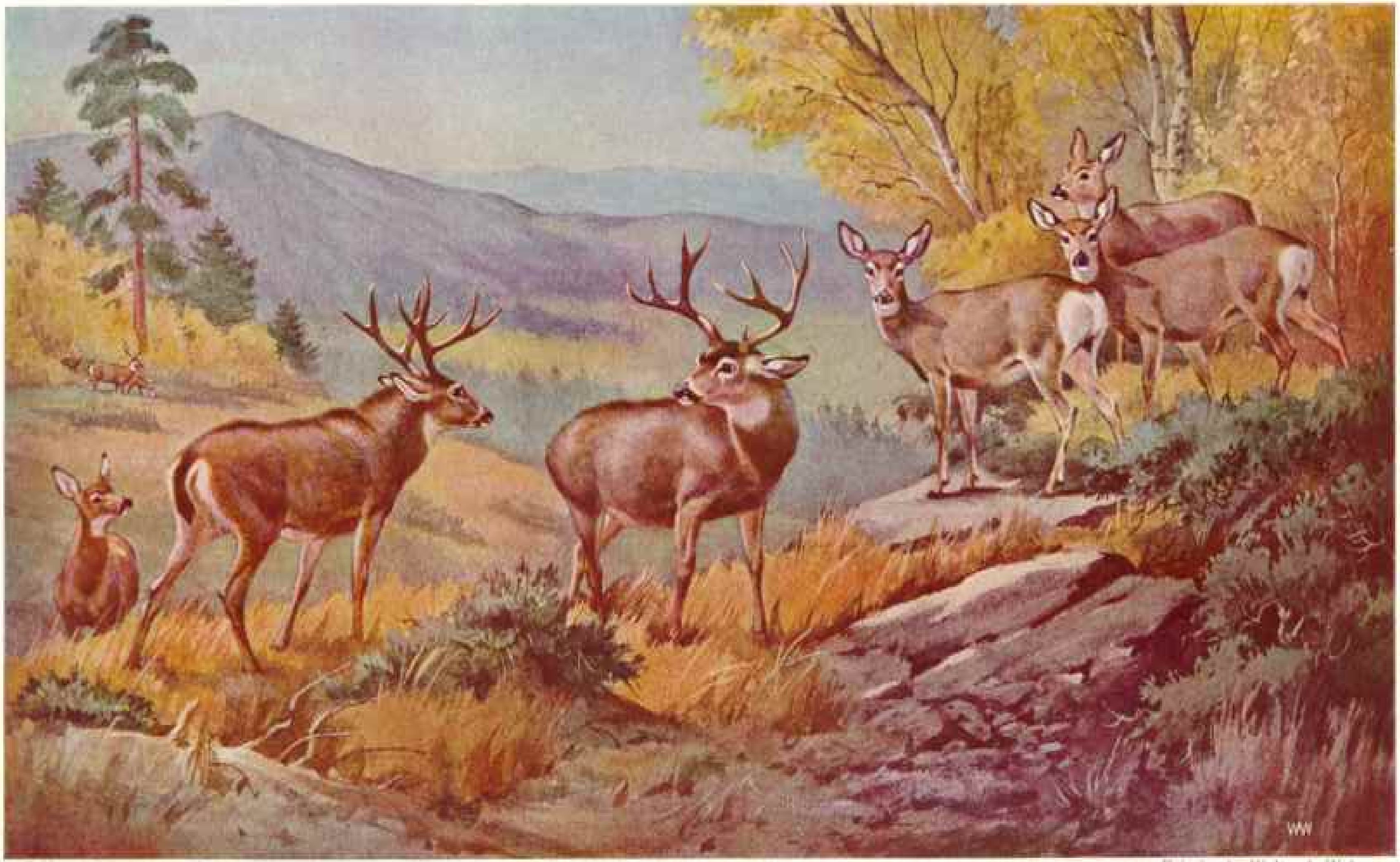
The larger and darker Roosevelt "elk" (*Cervus canadensis occidentalis*) inhabits the rain forest and northern redwoods belt of the Pacific Northwest, while the much smaller, paler tule "elk" or wapiti (*Cervus nannodes*) remains only in Kern County, California. Wapiti, however, are not exclusively North American, and other species are found in northeastern and central Asia.



Painting by Walter A. Weber

WITH A WELL-DIRECTED LUNGE A WAPITI BULL DRIVES BACK A FOE; VICTOR'S PRIZE IS THE HAREM OF SPECTATOR COWS

"Elk" is the common, although strictly incorrect, name for this big deer, whose martial bugling still rings in western mountains. Yellowstone National Park and the Jackson Hole country in Wyoming support today over 30,000 **Wapiti,** while the total population of this race is probably more than 165,000. Restocking has brought back the American elk in small herds to several eastern regions.



Painting by Walter A. Weber

"I'M BOSS HERE. STAY AWAY!" A BUCK MULE DEER (CENTER) DISTRUSTFULLY CONFRONTS A BLACKTAIL (LEFT)

A tail all black on the outer side distinguishes the **Columbia Blacktail Deer** (with female, extreme left), which occupies the heavily forested strip along the Pacific coast from Alaska to southern California. Larger and with wider-spreading antlers, the more numerous **Mule Deer** (with three does, right) ranges from central Alberta, the Dakotas, and Texas to the Pacific. From behind, it shows a whitish patch. The white tail has a black tip.

Mule Deer

Odocoileus hemionus

With large ears scarcely more reminiscent of a mule than his blacktail cousin, the mule deer is distinguished by a white tail with a black tip (Plate V). Although he has two coats a year, it is said that the hairs of his tail last twelve months and the black tip never wears out. Carrying this extremity drooped, he swings it back and forth over the white patch on his rump (page 473).

His habit of bounding into the air like the blacktail and landing on all four feet when running at high speed has given him the colloquial name in Manitoba of "jumping deer." Because of his ears and gait he is also, and more commonly, called the "burro deer."

He has a light-gray face with black on the forehead, and his coat is rusty yellowish red in summer, a warm brownish gray in winter. His legs and underparts are an unchanging gray. Standing 3½ feet high, he averages a weight of 150 to 200 pounds, but on rare occasions has been known to weigh more than 400.

The tines of the buck deer's antlers are typically branching, and the mature to old males frequently carry freak antlers that may have more than 50 "points." These monstrosities, however, lack the beautiful symmetry of more ordinary antlers. Antlered does occur abnormally from time to time, as in other species, but these are rare individuals, seldom capable of bearing young.

West of the one-hundredth meridian, and from the northern Canadian forests to the Tropic of Cancer in Mexico is the home of the mule deer. They avoid deep forests, for the real habitat is partly open, partly wooded. Originally they were said to be numerous on the open plains far from cover, until man took all but the rough country for his own use. As a group, however, the mule deer are versatile, for they are found from the burning deserts of the southwest to the humid, cold mountains of the north.

Most of their territory is mountainous and in winter the snow becomes too deep for them at high elevations. Therefore mule deer are usually migratory, moving to the low country when cold weather arrives. Considerable numbers congregate at this time, and the fawns, although now in their somber gray grown-up dress, chase one another in play.

With the spring breakup the deer scatter, moving singly or in little groups back toward the summer range. Like most polygamous males, at least in the deer classification, the mule deer bucks desert the does until the next fall. At this time the deer especially crave salt, and the licks are well patronized. Perhaps this urge is akin to our own desire for greens after a long winter, and is the result of deprivation of certain minerals.

Their menus are greatly varied. During the winter of the north, they must paw through the snow for mosses and lichens and reach for twigs and evergreen foliage from the trees. In the far southwest where there is little water they often get their moisture from the cactus. Although dead deer have been found with spines penetrating their stomach linings, they usually manage to avoid (or perhaps digest!) the prickly needles.

Like most gregarious deer, the bucks meekly spend the winter in the herd, often led by a wise old doe. In times of flight they may get ahead because they can run faster, but the rest of the time they depend upon her to find refuge, shelter, food, water, and the best licks.

Only half as large as a trumpeter swan's nest, the mule deer's beds are but imprints on the ground (four feet long), sheltered from the winds and with a good lookout.

The doe hides her one or two and very rarely three fawns in various places, always returning to nurse them morning and night. Their spotted red coats are similar to those of the whitetail, but duller and paler. When a human invader appears, the mother stamps her front feet in anger, and her rump bristles. Sometimes she will attempt to lead the intruder away by whistling and circling.

Columbia Blacktail Deer

Odocoileus columbianus

Along the Pacific coast of North America, from Sitka, Alaska, to San Diego is a close relative of the mule deer—the blacktail (Plate V). Except in California, where he spreads eastward over the Sierras, his range is like a shoestring, 2,000 miles in length and hardly 150 miles in width—probably the most oddly restricted of deer ranges. His aptitude for the moist forested country has apparently unfitted the blacktail for life in the arid plains, for he does not venture eastward beyond the rain belt.

Smaller than the mule deer, this blacktail buck of the coast seldom weighs more than 150 pounds. As in the former, the typical tines are forked, but only seldom do all the tines of a set of antlers divide. The two animals may be easily distinguished by the color of their tails. The blacktail's is black, faced with white underneath, and the mule deer's tail is white with a black tip. Not prominent in ordinary flight, the tails of both deer wave rapidly in little circles over their white rump patches when the animals are wounded (page 473).

In October the blacktails are fat from an acorn diet and ready for winter in their thick coats of brown hair finely sprinkled with blackish. The bucks, which have led an aloof and bachelor existence all summer, are resplendent and proud of their polished antlers. Throughout the November courtship season, their necks are swollen to almost twice normal size as they roam the woods looking for mates.

By December and severe winter weather, the deer are run-down in flesh and in poor con-

dition to meet the period of food scarcity, the hungry wolves, cougars, and lynx. With winter's breaking they scatter to higher pastures released from the barriers of deep snow. They nibble the first shoots of the skunk cabbage and eagerly feed on the sprouting browse of oak, hazel, chaparral, ceanothus, seaweed if necessary, an occasional seasoning of toadstools and other fungi. Rapidly they put on new weight.

Although springs and creeks are frequent, the succulence of their browse makes it unnecessary for them to drink for days at a time. The battered and sometimes broken pairs of antlers, which warded off so many blows of last fall and were dropped in the winter, are being replaced. In April the new pair are only fuzzy knobs, but will be fully grown, though still in the velvet, by July.

In May or June the blacktail doe establishes her nursery with one, two, and sometimes three dappled red fawns. In the wooded home their spots may be mistaken for flecks of sunlight shining on the forest floor, and, when danger threatens, the fawns lie flattened and as still as the ground itself. The mother comes to nurse them several times a day until, a month or six weeks after birth, they are able to travel with her.

Virginia, or Whitetail, Deer

Odocoileus virginianus

Proudly flying at full mast or ducked and dragging between their legs, the white tails of these graceful animals are governed by their emotions (Plate VI). Waving madly in fear, flapping ecstatically in mating season, slapped down flat and quivering with pain, they tell the story more poignantly than whistles of alarm and snorts of anger.

The most vivid impression of any encounter with one of these graceful creatures is the waving white flag bobbing away into the forest. As the tail erects, the long hairs rise and spread, so that the total effect is that of a shining feathery banner (page 473).

Ahead of the tail goes a reddish-tan animal (if the season is summer), white muzzle, chin, throat, and underparts. A good look discloses the sleek shining coat, "trained-down" muscles, slender legs, small tapering black hoofs, alert, slim face, and large melting brown eyes. In winter the red coat is replaced by gray, or "blue" as the hunters call it.

Whitetails are found haunting woods and forest borders, from the northern limit of the Canadian forests south to Peru and Bolivia. Generalizing, one may say that the size decreases as one goes southward. The northern deer may stand 40 inches high at the shoulders and weigh 300 pounds, although giant bucks of 400 pounds have been recorded. Several varieties in Mexico scale less than 40 pounds.

More frequently fed than many deer babies, these one, two, or three polka-dotted fawns are nursed by their mothers a half dozen times a day. Not until September are they completely weaned and given new coats without spots. During the rutting season (October and November) the does are too busy to look after them, but with the advent of real winter they again keep an eye on the youngsters.

During the deep snows the deer congregate in cedar swamps. By force of numbers and constant moving about they keep trails broken, forming what is called a "yard." However, available food, the hardwood or cedar browse within reaching distance, sometimes runs short. Nature imposes a strict and brutal population limit on her deer children by allowing the "excess" to starve to death, and it is in winter that the northern deer feel the pinch.

During the summer there is ample room and food. This is the time of plenty, when the doe and her May-born twins or triplets move about in the morning or evening, daintily sampling the most delectable foliage, exploring the shallow waters of ponds and streams for water plants, and looking for windy hilltops where the obnoxious flies will not trouble them. This too is the time when the buck, in the quiet seclusion of some aspen grove, is contemplatively chewing his cud while his antlers grow and harden for use against rivals in the coming fall.

Whitetails love to swim, perhaps as fast as four miles an hour for a short interval; and at times they lie in the water for hours seeking refuge from mosquitoes, black flies, and deer flies. On land they can travel about 25 miles an hour for three or four miles. An occasional leap carries them over brush or gives them a better view of the terrain.

Reaching the prime of life in seven years, they begin to fail at the ripe old age of 10. They do not experience senility, for disease, starvation, a predator, or man dispatches them at some time within the next five years.

If given certain essentials of home, food, and protection from overhunting, the whitetail as a species has remarkable ability to survive and even prosper under adverse conditions. Theoretically, two dozen does will have more than 3,000 descendants in ten years.

In the northern United States the whitetails have gone through a cycle of extreme scarcity because of unreasoning slaughter, but have become numerous or even too abundant when conservation measures were applied. Some of our most populous States have large numbers of this species.

During the 15-day hunting season of 1937 in Pennsylvania, 25,000 bucks were bagged, probably more than the annual increase being killed. Even more amazing are the figures of 1935, when the surplus deer population made it necessary to declare open season on both does and bucks. Hunters carried home 23,802 bucks and 46,000 does!

WITH LONG BOUNDS, A WHITETAIL BUCK AND DOE FLEE FROM PURSUING WOLVES

They wear their brownish-gray winter coats. When excited, the still-abundant **Virginia,** or **Whitetail, Deer** raises its tail, whose white underside is the "flag" that flashes and bobs as its owner runs.

 Paintings by Walter A. Weber

"STOP, LOOK, AND LISTEN, MY CHILDREN, IF YOU WANT TO LIVE AND LEARN!"

A **Whitetail** doe in rusty-red summer dress and her two fawns freeze in mid-stride. Perhaps it is the youngsters' first sight of a muskrat on a fallen log.

RABBITLIKE DEER HAVE LARGE EYES, ARCHED BACKS, AND SHORT TAILS

At extreme left is a **Red Brocket;** beside him stands a **Brown Brocket.** Both are small deer of Central and South America. The tiny **Chilean Pudu,** running, is the smallest true deer.

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THE PERUVIAN HUEMUL LIVES HIGH

It roams the upper slopes of the Andes. The Chilean Huemul, a southern relative, is a somewhat larger and browner animal, with straighter and heavier antler tines.

Brown Brocket

Mazama simplicicornis

With very short tails, arched backs, and simple, unbranched spike antlers, these small deer of the New World are named by a term originally applied to young European red deer stags (Plate VII). They are distributed over most of tropical and subtropical America, from Vera Cruz, Mexico, south to Paraguay, and in altitude from sea level to 16,000 feet. The zoologist divides these deer into two groups, brown and red.

There are a number of species and races of brown brockets, the color varying in the different forms from dull brown in Paraguay and southern Brazil to a yellowish gray-brown in the Guianas, Venezuela, and northern Colombia. No member of the genus inhabits the Andes north of Peru.

Only 19 inches high, the "simple horn" brown brocket is comparatively light and slender. Individuals deviate in color from brown with a pepper-and-salt finish to gray or whitish. The spike antlers are dirty white, and the longest pair known, according to Lydekker, measures but 5½ inches. This small creature is found in the Guianas, Colombia, Bolivia, Brazil, and Trinidad.

Wary and difficult to approach, "simple horn" does not live in the thick coastal forest but inhabits the open *campos* or grassland with occasional stunted trees and open forest. Agriculturists in Trinidad are said to dislike him and his brothers, which are abundant on the borders of cocoa and nutmeg plantations and cause much damage by browsing on the tender shoots and young trees. Brazilian natives call this little deer the *vira* or *veado catingueiro*. The mother brocket produces two white-spotted fawns annually.

Red Brocket

Mazama americana

Red brockets are distributed over much the same geographical range as their brown cousins, from tropical Mexico to Paraguay and Bolivia (Plate VII). In their habitat requirements they are, however, somewhat at variance, for they prefer the dense jungle to the open *campos*, where they occur sparingly. They range in color from dark chestnut red to a distinctly yellowish red, with the middle of the back, the head, and neck varying from black to dark brown.

The typical red brocket (*Mazama americana*) is larger and heavier than the brown brocket (*Mazama simplicicornis*), measuring 27 inches high at the shoulder. At a distance his coat appears to be a uniform glistening brownish red, darkening to black on the back, head, and neck. Close up, however, the sides have a grayish tinge, the throat and inner sides of the thighs are grayish white, and the tail has a brownish cast above with white underneath and at the tip. In Brazil, where he is found quite generally as well as in the Guianas and Paraguay, the red brocket is called *veado pardo* or *veado mateiro*.

At sunset the solitary brocket leaves his "form" or bed in a thicket to feed or browse. The neighboring plantations are particularly popular, for the animal is fond of melons, corn in the milk state, cabbages, and other garden produce. The outraged owners seek retribution by trailing the marauder with dogs. Good hounds are able to run down the brocket in a half hour if the forest is not too dense. Water is a haven of refuge, for it leaves no evidence, but the fugitive is doomed if he cannot reach it quickly.

Different naturalists have observed the red brockets courting at different times of the year. Probably, under the Equator where seasons are poorly defined into "rainy" and "dry," there is no special time for mating. At any rate, the bucks and does afterward go their separate ways, and about six months later the single spotted fawn is born. In three to five days the youngster can follow his mother on her nocturnal excursions. For some time, however, he has little speed or endurance, and, when danger threatens, the mother conceals him in a thick covert and heads for the nearest stream.

Chilean Pudu

Pudu pudu

The Chilean pudu is the smallest deer in the world. A glance at Plate VII will show that he is closely related to the brocket. However, his coat is much coarser and more brittle than his cousin's. Reddish brown, speckled with a paler shade, darkest on the head, it blends into a grayish tinge on the neck.

Standing only 12 or 13 inches high, the Chilean pudu has short legs, diminutive spike-like antlers, and a tail almost too brief to mention. Small-eyed and broad-eared, he wears an odd little tuft of hair that grows in a crest across his forehead and ends around the base of his horns. Living in the Andes of central and southern Chile, he migrates down to the plains during the winter. He usually skulks in dense forests and thick undergrowth.

A related species, two or three inches taller, lives in the mountains of northern Chile, Peru, and Ecuador. He is similarly colored, but has very dark legs and feet and is flecked with bright rufous instead of pale brown.

Peruvian Huemul

Hippocamelus antisensis

In the Andes of Peru, Ecuador, Bolivia, and northern Chile, living at elevations of from 11,000 to 16,000 feet, is a gray, rather stout, heavy-bodied deer. The Indians call him *huemul* or *guemal* (Plate VII). His short, bushy tail is partly bordered by black, his throat is smartly white, and his long ears are

sharply pointed. Rising from the buck's head is a characteristic pair of weak, two-tined antlers, forming a single fork which is curiously close to the base. Somewhat smaller than an average North American whitetail, he stands about 34 inches high.

Like other deer whose homes are located on the Equator, the Peruvian huemul knows only the dry and rainy seasons. Since there is too little change of temperature to cause a winter and summer, he is not a migratory animal like his close cousin, the huemul of Chile. Instead of being driven from high forests down to the open valleys and back again, he stays comfortably at home year after year.

The Chilean huemul (*Hippocamelus bisulcus*) is five or six inches taller and distinctly brown in color. His face is strikingly marked by a broad black line running from the muzzle to a point between the eyes, where it divides like a Y. Large exposed glands lie conspicuously below his eyes. The antlers are heavier than those of the Peruvian deer and the two tines fork about two inches above the base instead of next to the head. Both sexes possess canine teeth in the upper jaw, but these incipient weapons do not project beyond the lips.

The Chilean species is most abundant at the extreme southern end of the continent, although its range extends north to central Chile. In summer it lives in the dense forests of the Andean valleys, but winter snows induce its annual migration to the foothills and neighboring plains.

South American Marsh Deer

Blastocerus dichotomus

Although Nature did not neglect the South American Continent when she was distributing deer, she gave all the large species but one to other parts of the world. This single exception is the swamp deer, which is found throughout Brazil, part of the Guianas, south through Paraguay and Uruguay to the Chaco of interior Argentina (Plate VIII).

In summer his coat is a bright chestnut red, which changes in winter to a brownish tone, becoming paler on the flanks, chest, and neck. The lower half of the legs is black, and the under throat and inner side of the ears are white. As large as the red deer of Europe (48 inches high), the buck carries a fine set of antlers with tines which fork something like those of the North American mule deer.

When they are disturbed by enemies, the marsh deer remain hidden in the jungle along rivers or in palm "islands" during the day. They have been well named, however, for their normal habitat is marshland. Some authorities say that they are gregarious and travel in bands of three to five animals. Of course the does stay with their fawns, but Miller found the bucks in Matto Grosso living alone except during the mating season.

Hunting, unfortunately, is all too common. Thousands are shot for their hides alone, although the return hardly reimburses the natives for the ammunition expended. The hunters consider the flesh of the *veado galheiro grande* or *guazupuco* as almost unfit to eat unless other food cannot be obtained. Against natural enemies the marsh deer can hold their own, for their rocking run, while appearing laborious, is effective in the soft, swampy ground of their native home.

Pampas Deer

Blastocerus bezoarticus

The mother pampas deer shows the greatest solicitude for her lighter-colored fawn (Plate VIII). When danger appears, she first stands guard while her child hides himself. Then she attempts to decoy the invader by running off in the opposite direction. If she fears that he will not be sufficiently impressed, she pretends to be wounded by limping ostentatiously.

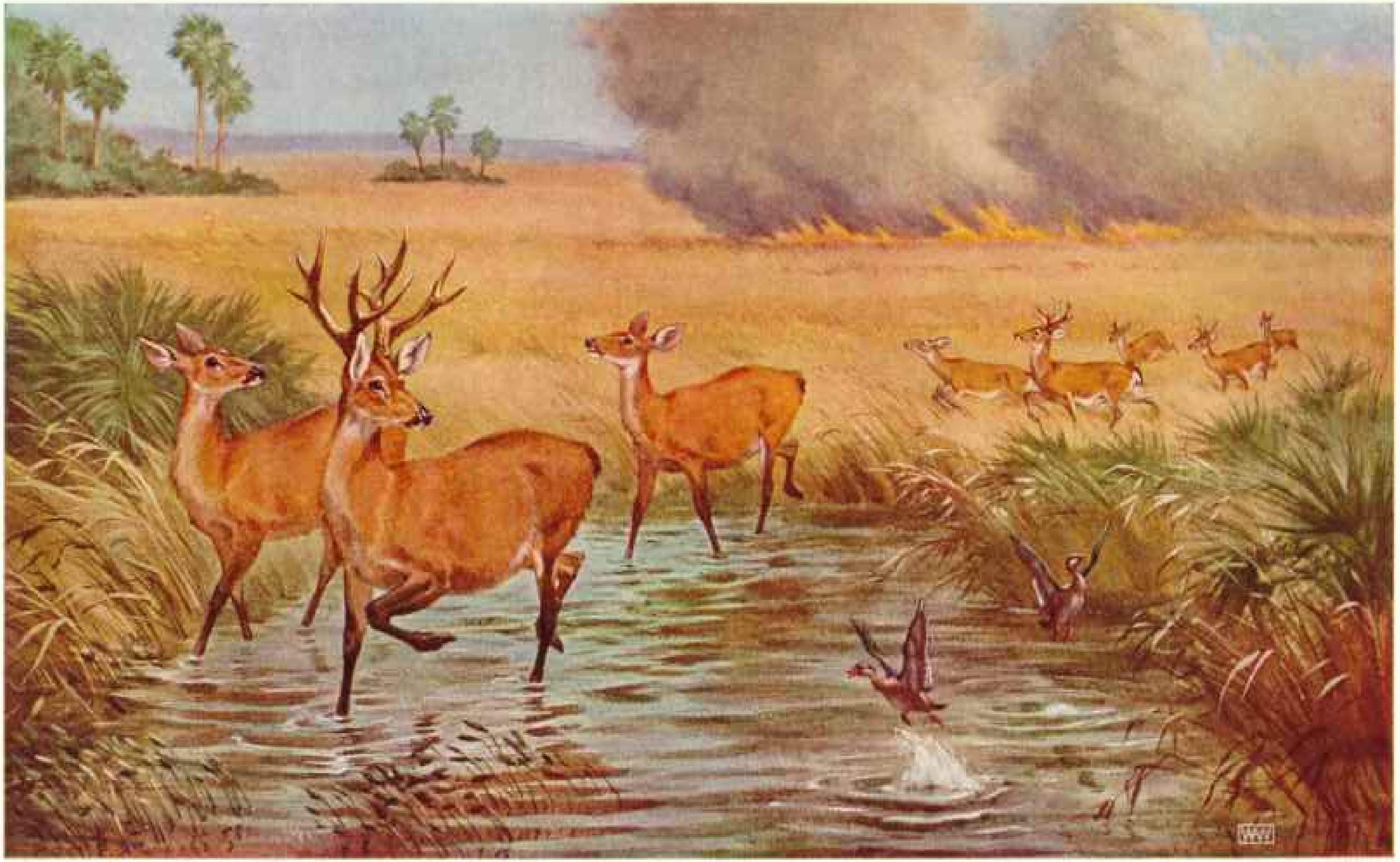
The characteristic odor of the pampas deer, which is penetrating and disagreeable to human nostrils, is said to be perceptible nearly a mile away. This powerful scent is exuded from a sac located between the phalanges or toes of the hind feet. Hunters can tell when an animal has been startled or routed from his bed, for in such instances the stench is particularly noticeable. Normally, it probably serves as a means of communicating certain information among the deer themselves.

As the name implies, the pampas deer are found on the prairies of the Argentine. Their range extends north, however, over the *campos*, or tree-dotted grassy savannas, of Uruguay, Brazil, and Paraguay into the forested section of the Argentine Chaco.

The open pampas were originally dotted with clumps of tall grass which furnished some shelter and concealment. Although this growth has been eliminated by cattle grazing, the wary deer are able to persist. They run swiftly and gracefully, easily leaping over an occasional bush or other obstruction. Even in flight on the open plains they continue to jump into the air, perhaps either as a habit inherited from their bounding ancestors or to obtain a better view of approaching danger.

When startled, they whistle a low sharp cry of alarm. Because they are especially fond of succulent green grass, their favorite haunts are the burns where new grass is coming up. The native cowboys (gauchos) sometimes test the speed of the best horses by running down the pampas deer armed with *bolas* or lassos.

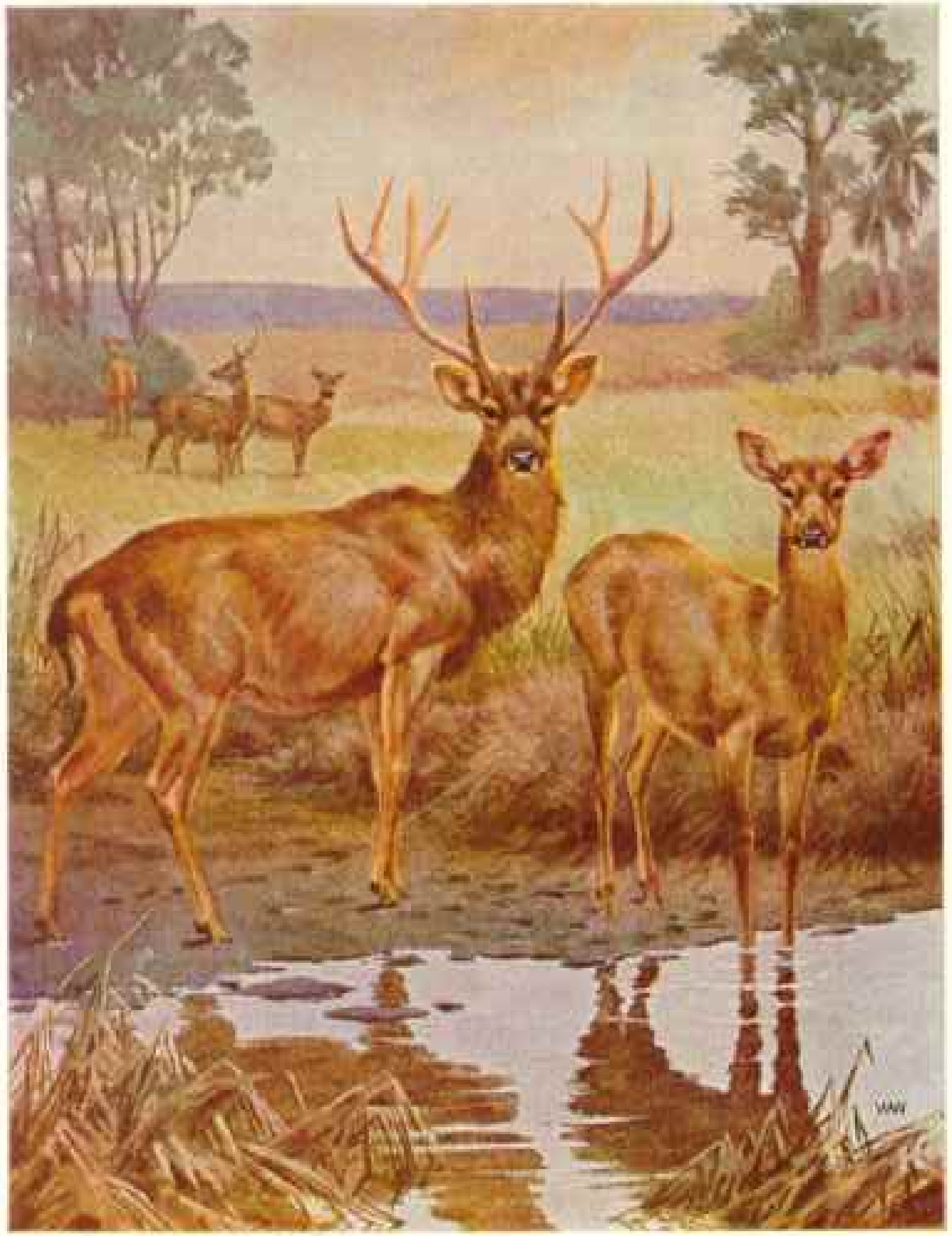
In Matto Grosso the three-pointed antlers are shed during May and new ones begin to grow immediately. At this time the deer are generally solitary. By September the rapidly grown horns are mature and free of velvet, and the bucks and does collect in bands of a dozen or more individuals. Old males, however, may remain apart in grumpy solitude.



Painting by Walter A. Weber

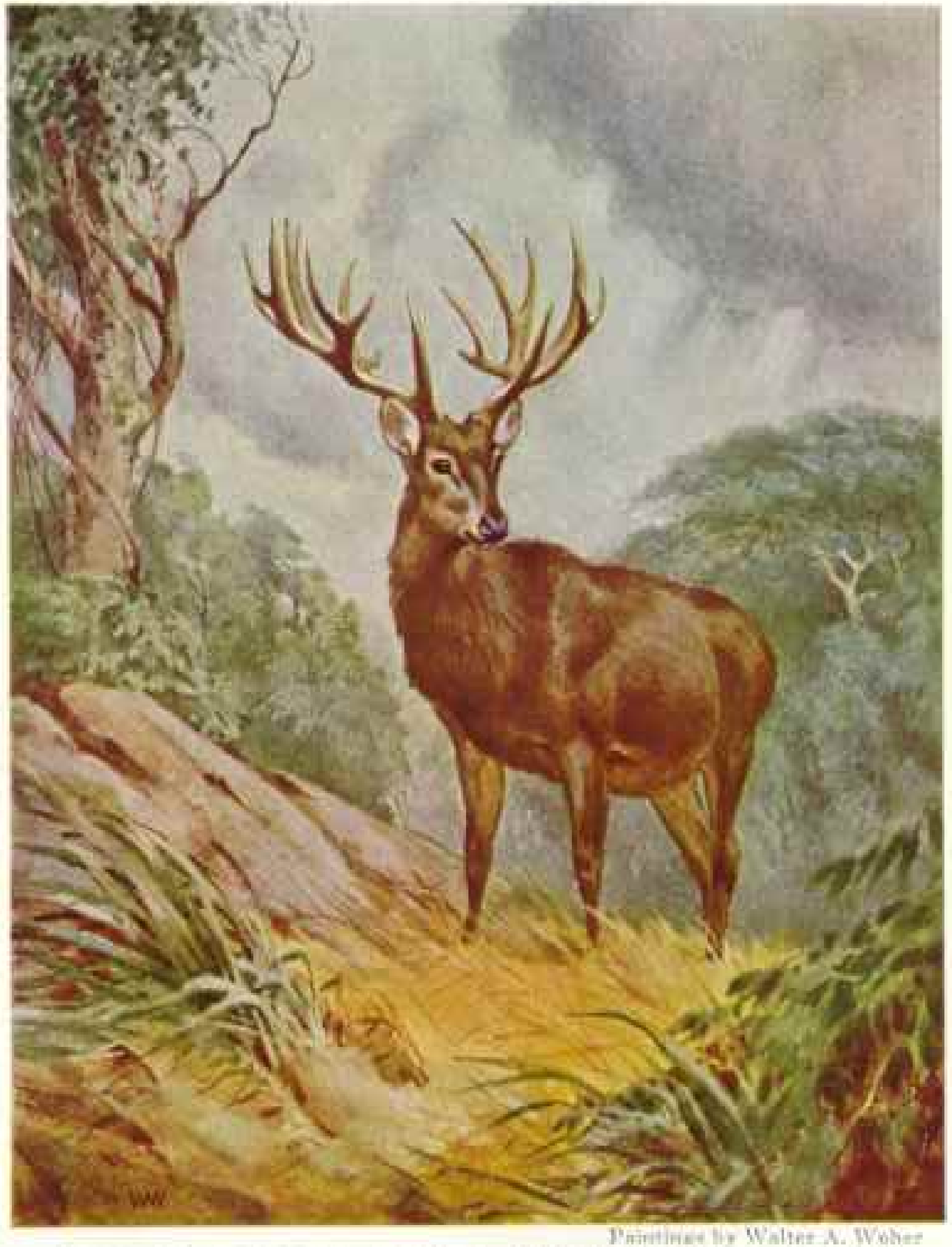
A RAGING GRASS FIRE ROUTS DEER AND DUCKS FROM A SOUTH AMERICAN SAVANNA

Splendid many-tined antlers crown the large buck **Marsh Deer** (left, with two does). He and his kind frequent marshes and riverside jungles in Brazil and northern Argentina. Much smaller is the **Pampas Deer** (right), which lives on the dry, grassy plains and travels in herds. Expert gauchos sometimes capture these swift creatures with their lassos or weighted bolas.



GIANT OF THE PLAINS, THE HAUGHTY BARASINGHA

Individuals sometimes weigh a quarter of a ton. The species is native to peninsular India. Herds of several hundred may travel together, breaking up only at fawning time.



Paintings by Walter A. Weber

"MISSING FROM OLD HAUNTS: PLEASE NOTIFY IF FOUND"

Schomburgk's Deer, of southeastern Asia, has not been reported from its native habitat in recent years. A few are wards of civilization in zoos. Magnificent antlers may show as many as 20 points.

Photograph by Courtland DuRand

PROUDLY A TEAM OF TRAINED ELK PULLS A WAGON ACROSS A NARROW DAM

On his ranch for big game in Montana, Mr. Courtland DuRand raises and protects herds of wapiti, buffalo, antelope, and deer. After weeks of tireless handling, he broke a pair of elk to harness and taught four others to carry packsaddles. Mr. DuRand has also schooled his animals to dive into a lake from a 40-foot tower.

Barasingha

Cervus duvaucelli

The large, heavy barasingha or swamp deer is found in the Central and United Provinces of India and, eastward, in parts of Assam (Plate IX). It is considerably larger than our own mule deer, for a good stag stands 54 inches high at the shoulders and weighs 400 pounds. An exceptional fat animal may scale up to 560 pounds.

The fine, smooth, and rather thick coat is yellowish brown in winter, changing for the summer to a light rufous brown, usually spotted with white, especially along the darker back. The doe is modestly paler than her lord and master, who regally tosses antlers rising fully 40 inches from his forehead. The smooth horns are unique. Above the brow tine the beam is unbranched for more than half its total length before sending off the usually precise number of 11 tines. This has given rise to the Indian name *barasingha*, which, translated, means "12-tined deer."

Except in the northern portion of its range, "swamp deer" seems a misnomer, for elsewhere the barasingha is confined to tracts of sal forest. His habitat and range, incidentally, correspond with those of the red jungle cock, the ancestor of our domestic poultry. Preferring to graze rather than to browse, the swamp deer frequents the outskirts of woods or grassy plains dotted with trees—never thick jungle. Although he rests in the middle of the day, night is not so exclusively feeding time as it is for a number of other kinds of deer.

In northern India the swamp deer lives up to its name, for here it inhabits marshland and is seldom out of water. In places in this type of country, a few miles of swamp may be home for thousands of the animals.

With the beginning of the winter season, the swamp deer collect in bands of 30 to 50 or even several hundred animals. Mating commences late in October or the first of November. The eerie, penetrating roars of the males are thrilling and impressive.

Each stag acquires a harem that may number as many as 30 does. By January or February the lordly antlers have served their function of display, offense and defense, and are shed. The bucks, however, are not long crownless, and new antlers are already in the velvet at the end of March. The single spotted fawn is born in the spring.

Schomburgk's Deer

Cervus schomburgki

One of the rarest of all the deer tribe, Schomburgk's deer may now be extinct, except in zoological parks (Plate IX). There are no records of its habits in a wild state, and probably, like the milu (Père David's deer), it exists only as a ward of civilization. In 1937, while visiting Siam (Thailand), where the species was formerly confined, Dr. Harold J. Coolidge, Jr., of the Museum of Comparative Zoology at Harvard University, was unable to get any report of a continued existence in its range, the northern districts of that country.

About 41 inches high at the shoulders, Schomburgk's deer is slightly larger than the average whitetail deer. The uniform brown color of his long, coarse winter coat is lightest on cheeks and flanks. Underparts and lower lip are whitish, and there is a distinct reddish tinge on the upper lips, on the back of the head, and on the legs. As can be seen in Mr. Weber's painting, the antlers are large and complex. Above the long, heavy brow tine the beam is very short before branching into two equal-sized forks, which in turn branch again into pairs of tines.

Sambar

Cervus unicolor

Animals living in the Tropics where the seasons are not clearly delimited frequently acquire unusual customs. Conventional bucks drop their horns and renew them annually, but the sambar is eccentric (Plate X). Built perhaps of sterner stuff, his powerful antlers give him lusty service for three or four years.

Possibly because he is so large (600 and even 700 pounds in weight), the sambar is sometimes called "elk" by Indian sportsmen. Somewhat resembling the American "elk," or wapiti, in size and form, he also wears a light patch on the buttocks. His general color, however, is dark brown, and his antlers are more massive with only *three* heavy tines.

Greatest of all sambars, the Indian species stands 54 to 64 inches high at the shoulders. Others nearly as large extend eastward across Ceylon, Burma, the Malay Peninsula, Siam (Thailand), and southern China, and also occupy Borneo, Hainan, Formosa (Taiwan), and the Philippines. Sambars prefer rolling or hilly country and live in the Himalayas as high as 9,000 or 10,000 feet above sea level. Much of this range is also occupied by tigers, and many deer fall prey to them.

Although sometimes found living alone, the sambars are generally encountered in small bands of 4 to 12. Resting in dense woods of the higher hills during the day, they move down to grassy openings to feed at night. They often commandeer the hospitality of sugar cane plantations, but they are also fond of other leaves and shoots, grass, vegetables, and wild fruits, especially ripe mangoes. Because of their fruit diet, it is claimed that they can go without water for several days.

"FOUR EYES" TO THE CHINESE

During the rut, which takes place in November and December, the sambar buck walks stiffly, with tail outstretched. His face glands evert widely, giving out a strong smelling secretion, and his eyes roll until the bloodshot sockets are exposed. Because of the open glands below his eyes, he is called "four eyes" by the Chinese. Morning and evening, and on into the night, he bellows, a loud, somewhat metallic roar quite distinct from the alarm note—a sharp short "ponk." The amorous doe, attracted by the sound and by the scent of the face glands, responds with a faint, grunting low.

The only other sound emitted by these deer is a hissing snort given when they are alarmed. This is often accompanied by the stamping of a foot.

FAWNS NEVER SPOTTED

The sambar mother gives birth to one or sometimes two fawns in late May or early June, at the commencement of the rains. Unlike other fawns, these chocolate-colored youngsters are never spotted.

Sambars are sought for both food and medicine. The meat is coarse and dry, but palatable. Their antlers are believed by many Chinese to have great therapeutic value when taken in the pulpy velvet state. These magnificent animals are difficult to hunt, for they are very wary and, merging into the shaded jungle background, are almost impossible for the hunter's eye to distinguish. Although extremely active and agile in the jungle, they are not particularly speedy and in the open can be run down by a good horse. Since the time of the Greeks, they have been known to thrive in captivity and today are bred in many zoological parks.

Painting by Walter A. Weber

TOSSING HIS MASSIVE ANTLERS IN VAIN, AN AMBUSHED SAMBAR RECOILS FROM A TIGER'S SUDDEN ATTACK

To avoid the menace of the deer's deadly sharp tines and slashing forelegs, the roaring cat has attacked from behind. Two does bolt away. A stocky animal, the **Sambar** of southern Asia may stand as much as four and a half feet tall at the shoulder. Usually it moves in parties of four to twelve, hiding in thick cover during the day and feeding at night in glades or even in sugar-cane plantations.

Painting by Walter A. Weber

IN SHADY ENGLISH PARKS, DEER LEAD A HALF-DOMESTICATED LIFE

One of the commonest is the **Fallow Deer** (animals to left of tree). Originating in Mediterranean countries, it was probably first introduced to the British Isles by the Romans. The spotted stag, with handsome palmated antlers, and doe (left foreground) show the normal summer coat. Other color phases occur; for example, the dark form (extreme left) and the white (center background). At the right, a **Roe Deer** pauses with two does. Roe stags pursue the females in circles, wearing "roe rings" in the ground. The European race of this species ranges over central and southern Europe.

Fallow Deer

Cervus dama

The ancient Romans are supposedly responsible for introducing the fallow deer to England (Plate XI). The animals have never been "wild" there, but have been kept under fence for almost 20 centuries. For the last four or five hundred years, the species has been an essential living ornament of every wealthy nobleman's estate.

Standing about three feet high, the fallow deer elegantly display their antlers, which flatten or palmate like those of the moose, but usually only to a width of three or four inches, and rarely as much as eight inches. From May to October, the deer of the normal species are clad in dainty yellowish-brown coats dappled with white spots on the back and flanks. In winter they change to dark brown trimmed with dun on legs and belly.

Spectacular white and black phases of the fallow deer, not spotted, are valued highly for ornamental purposes.

Little is recorded of the habits of this deer in the wild, nearly all the literature relating to park animals. Does and young are very gregarious and stay in large herds. Through the rutting season and early winter they are joined by the bucks. The young, born in June, are usually single, but occasionally twins occur.

Fallow deer like the leaves and twigs of most deciduous trees, but the majority of their subsistence comes from grass and other herbs. When horse chestnuts are ripe, they consume large quantities of the bitter nuts. During the winter, in northern Europe, they must be fed hay and corn, for natural food in the overgrazed parks is not sufficiently nutritive for these natives of warmer lands. At this season they feed throughout the day. In summer, on the other hand, they usually move about in the evening and early morning. In the damp, cool English climate the infrequent sun is welcomed, and on hot days the deer lie stretched out in the forest openings, absorbing the ultraviolet rays. When startled, they jump up with a grunting "bark."

Several varieties have been developed in captivity. Stature, and especially antlers, have in some cases suffered marked deterioration from inbreeding. In spite of centuries of confinement, the race is still essentially wild, and at times the bucks attack humans with too frequently fatal results. They are all the more dangerous because they appear friendly and gentle. On a recent visit to Germany, Dr. Carl P. Russell was nearly knocked over by one of these deer just as he was about to board a streetcar in the suburbs of Berlin. The deer meant no harm at this time, but was hastily escaping a pack of dogs.

Fallow deer are native to southern Europe—Portugal to Greece, parts of Asia Minor, northwestern Africa, and the Mediterranean islands of Rhodes and Sardinia. They are also kept in a semidomesticated state in southern Sweden, in Italy, and in Tasmania as well as in Britain. A related race, larger and more brightly colored, is found in the mountains of Iran (Persia).

Roe Deer

Capreolus capreolus

In contrast to all other deer, the roe buck is frequently monogamous (Plate XI). Although it is not usually necessary to fight for his wife each summer, he indulges in occasional vigorous disputes with his fellow bucks. Faithfully he stays at home month after month, but is driven out in the fawning season of May and June.

During this period of exile he is apt to journey far and wide. He then begins a new life with another doe or returns to his stay-at-home wife in time for the mating season and to help raise the children. Unlike most deer fathers, he not only is likely to know his own sons but is supposed to be as energetic as the doe in defending them.

The spotted fawns born in May are generally twins, occasionally triplets, and sometimes only a single youngster. The mother hides her offspring in dense undergrowth for about ten days until they are strong enough to move about with her.

These slender, rather small deer, with two or three-tined antlers rising very close together and almost vertically above the bucks' heads, stand about 26 inches at the shoulders and average 40 pounds in weight. Their new thin coats, almost as red as the traditional hunting garments, slowly fade with the wear and sun of summer and are shed in autumn for the thicker and coarser winter attire of dark speckled brown with a large white rump patch. As in a few other deer, the hairs of this patch rise and fall according to the state of the owner's emotions. Albinos occur among the roes, as in many species, and have been reported in Scotland and Germany. The winter-grown horns are peculiar in lacking a brow tine and are normally only 8 to 11 inches long, but may attain a maximum of 15.

Although the males of most deer become sexually active soon after the antlers are mature and completely cleaned of velvet, roe bucks are not so eager to mate. The velvet is rubbed from the horns by the end of February, but their rut does not occur until July and August. At this time the males pursue the females in circles. These "rings" are used by the roe deer the rest of the year for exercise and diversion. Sometimes a lone deer will practice running around by himself. At other times as many as ten will engage in this pastime together.

Roe deer feed on grass and some browse. They are particularly fond of rowan berries

and often dig up fungi in the fall as a special treat.

When startled, they bleat harshly. With heads carried high, the animals dash off in a series of long, bounding leaps which generally subside to a trot. They make up for lack of speed by being adept at crossing and confusing the trail. They take readily to water, presenting a difficult problem for pursuing dogs. This species has always been a favorite object of the chase and is considered better venison than the red deer.

Quite unlike the sociable fallow deer, the roes do not congregate in herds. Generally only pairs or family groups are found together, haunting the dense undergrowth of broken high country forest, never thick forest or open plains.

Roe deer of several recognized varieties are found from England and Scotland, east across Europe and Asia (north of the Himalayas) to the Pacific. The best-known variety is seen in Britain, southern Sweden, Spain, and east to Asia Minor and northern Palestine.

Japanese Sika Deer

Cervus sika

Divided by zoologists into five races, the sika deer inhabit far-eastern Asia: Japan, northern China, Manchuria, and Formosa (Plate XII). With the exception of the large mandarin sika of China and Manchuria, which stands an impressive 48 inches at the shoulder, the sikas are not large. The Japanese form is 32 to 34 inches high and weighs 170 to 180 pounds, corresponding to a small whitetail of the United States.

The sika of Japan is a plain smoky brown in winter, changing with spring to a beautiful chestnut red spotted with white. The hairs of his white rump, edged with black, erect at the first sign of danger, warning his companions and subsiding only when his mind is at rest again.

Although Japanese scientists have studied this deer in his native home, their work has not been translated into European languages. We know little about the animal's natural way of life, except that he inhabits the darkest forests, preferably in hilly country.

In captivity this dainty, appealing deer is very popular with the Japanese. Family groups, when going to the country on outings, frequently take along little rice cakes to feed the park deer, just as Americans bring peanuts to the zoos to feed the bears.

The Japanese sika have been imported to Europe and New Zealand, where they have also been semidomesticated. In England they find conditions suitable and breed well. Resembling the red deer in habits, they have mated with this larger relative in zoos. During the rutting season the bucks give vent to their emotions by whistling, the sound sometimes passing into a scream. The doe produces only one fawn at a birth.

Axis Deer, or Chital

Cervus axis

The jungles of the alluvial plains and hills of India and Ceylon have produced one of the most beautiful of all deer, the axis deer, or chital (Plate XII). The native name *chital* (spotted) refers to his most noticeable characteristic, the decorative white spots which he wears throughout the year. These are so numerous on the bright reddish-fawn background that they sometimes form lines on the lower flanks.

A further mark of distinction is the handsome dark stripe which runs from the back of the head to the end of the tail. About the size of an average whitetail of our own country, the chital weighs from 150 to 180 pounds and stands approximately 36 inches at the shoulders. The outside curve of his imposing antlers measures about 39 inches.

The axis deer enjoy companionship of their own kind and congregate in herds sometimes numbering hundreds. Their friendliness even extends to other forest animals, particularly to monkeys, with whom they are often found. Water is an essential to these deer, for they must drink regularly. By the Indian sportsman they are always associated with grass-covered forest glades and heavily shaded streams. If good cover is available, hills or plains are all the same to them, and even human activities and dwellings are disregarded. Perhaps some of their self-confidence arises from knowledge that, in sun-flecked jungle, they are almost invisible, the spotted coats achieving this magic result.

After lying concealed during the day, the axis deer come out at evening to feed on tree shoots and grass. An alarm is given by a loud scream and immediately the whole herd disperses with long flying leaps. They swim easily and often take to water for ordinary travel as well as to escape enemies. The mother axis deer has only one fawn at a birth, which may occur at any time of the year but more usually during the cold season.

Such graceful, beautifully colored and marked deer as these are sure to be conspicuous and sought after. The Romans prized them for parks and exhibitions, and numbers have been imported to England in the last two centuries for liberation on estates. They have thrived wherever the climate is not too cold. Sometimes, as in New Zealand, they have increased to such numbers as to become a serious menace to crops and forests. For years the national park authorities of that country have hired a "deer exterminator" whose unpleasant duty it is to kill all the animals possible. Otherwise, the parks would be denuded by the rapidly multiplying and hungry deer.

JAPANESE PARK DEER BEG RICE CAKES FROM PICNICKERS

In its natural state, the **Sika,** of Japan and Manchuria, inhabits the deepest forests. It wears indistinct spots in summer and a suit of unicorn smoky brown in winter.

© National Geographic Society Paintings by Walter A. Weber

FOREST DEPTHS OF INDIA SHELTER BIG HERDS OF THE AXIS DEER

Often called the "Chital," this graceful animal owns a lovely coat of bright reddish fawn. Its abundant spots stay with it at all seasons.

KNIGHTS OF OLD FOUGHT HAND TO HORN WITH STAGS AT BAY

Bouts with the noble **European Red Deer** provided battle training. Reserved for the sport of nobles, these proud creatures were hunted with staghounds.

© National Geographic Society — Paintings by Walter A. Weber

FEW SPECIMENS REMAIN OF THE MOURNFUL-LOOKING MILU

Also called "Père David's Deer," the **Milu** has a long, taillike tail and antlers lacking brow tines. This oriental deer is not known in the wild state; a few are kept in parks.

Red Deer

Cervus elaphus

The famous red deer is known to all English-speaking peoples as the stag of literature (Plate XIII). Long before the Norman Conquest, the Saxons regarded the red deer as their most prized game. Throughout western Europe, since the formation of a distinct ruling class and until the French Revolution, this deer was reserved for the sport of the nobility and protected from commoners by rigid laws that carried severe penalties for infringement.

The chase gave the hunter an opportunity to test his courage and horsemanship. When brought to bay, the stag's strong horns were formidable battering rams from the short killing distance imposed by hand weapons. An old English saying expressed the risks of this hazardous sport or training for war in terse words: "Man goes from the boar to the leech, from the hart to the bier."

Red deer, of several races or subspecies, are found in suitable wild places (and of course in parks) throughout most of Europe (England and Scotland included, but Italy excluded), east to the Caucasus and into the Caspian provinces of Iran (Persia). A variety also occurs in northwestern Africa.

The typical European red deer is large, standing four feet in height at the shoulders and weighing a little less than 300 pounds. Record stags, however, have scaled 550 pounds. The reddish-brown summer coat, lighter on the face and underparts, changes to gray in the winter. Both coats have a small, light-colored patch on the buttocks.

These deer often wallow, especially in spring and fall, rolling luxuriously in the mud. This process is supposed to aid in removing their old coats.

Through the summer months the stags feed in the higher hills, perhaps because it is wilder there, but in early September they begin to seek out the hinds, which, with the young, have remained in the valleys. By October the rut is on in earnest. The stags battle furiously, sometimes to the death, for the favor of the females, which watch quietly from a distance and callously go off with the victor.

The rut ends, peace reigns, and a few months later the antlers that have given such active service are dropped. Although cast antlers are eaten by rodents and also by some hoofed animals in captivity, they rarely appeal to the palate of wild deer. In the British Isles, however, both male and female red deer gnaw the stag's horns after they are shed in early spring. Perhaps this satisfies a craving for minerals that are too scarce in the soil and plants.

In May or June the spotted fawns are born, usually singletons, but rarely twins. The mothers conceal the youngsters in heather or bracken, returning frequently to nurse them and never straying far away.

Milu

(Père David's Deer)

Elaphurus davidianus

In 1865 Père David often wondered what went on in the pleasure grounds of the Chinese Son of Heaven. At last he peeped to satisfy his curiosity. Being a naturalist, he was most of all impressed by the sad-eyed deer the like of which he had never seen before (Plate XIII).

Standing nearly four feet tall, they appeared to weigh about 500 pounds. The tawny-brown color was emphasized by dark chests, a ring around the neck, and stripe halfway down the backbone. Their shaggy coats mounted to manes on the neck, the long, heavily haired tails switched uneasily, and the horns, the branching tines of which seemed to make up most of the antlers, stretched 30 inches from their heads. As the good father watched, they looked up with a mournful expression and walked away with a peculiar, slow, stately gait that was accompanied by a loud clicking of the hoofs.

Because they wore long tails like mules, trotted like horses, brayed like donkeys, and had spreading hoofs like cows, the Chinese were not sure that these creatures were deer. They settled the matter by calling the milu *sze-poo-seang*, meaning "like none of the four" (horse, cow, goat, or deer). Since Père David was the first white man known to have seen the milu, his name has been associated with the species in Caucasian literature.

During the Boxer Rebellion a storming party from the attacking European expedition breached the outer walls of the Son of Heaven's palace, and the deer escaped, most of them only to be killed and devoured by the hungry peasantry. A few were recaptured, however, and were taken to England to the Duke of Bedford's estate, Woburn Abbey. Here a herd of about 50 animals is still kept.

They eat grass, rushes, and other water plants. The males' antlers are stripped of velvet in May and early June, and during the following two months the bucks bray like donkeys for new mates. Each doe has one or two spotted, tawny-colored fawns which, like their mother, will soon have the longest tails of all deer species.

No information survives on the habits of Père David's deer in the wild state. Probably originating in northern China and possibly Kashgaria, they are known to have existed in prehistoric Japan. Their large spreading hoofs lead one to suppose that they originally lived in marsh or boggy country.

Musk Deer

Moschus moschiferus

Most important of all deer to women is this quaint little creature which secretes musk for their perfumes (Plate XIV).

For many years zoologists refused to accept this animal as a member of the deer family. Less than two feet high, he scarcely looks like a deer with the ludicrous rump of his stout, heavy body rising two inches above his shoulders. His long hind legs reach out much farther than his front ones. His ears are large, and his tail has started but never finished. Lacking antlers since his world began, he has learned to fight his battles with long saberlike teeth.

Living as he does at an altitude of from 8,000 to 12,000 feet in the Himalayas and on the plateau country to the north, the musk deer must be prepared for severe winters. The thick coat of coarse hair keeps him well insulated during the long daylight hours that he lies concealed in cover. Emerging in the evening, this solitary little animal easily and surefootedly walks across the steep snow-covered mountainside in his search for lichens, grass, roots, and twigs.

His peculiar ability to stick to slippery ledges is due to the wide "false hoofs" (dewclaws), which are even larger than the narrow pointed main hoofs. His toes can spread far apart and are strengthened by stout ligaments.

The musk deer mates in January, and fawning time occurs the following June. Usually there is only one spotted fawn, and the precocious youngster may mate when less than a year old. This is Nature's rule with short-lived animals, and the musk deer has a life expectancy of only about three years.

Once he was abundant in the Himalayas, but demands of 19th-century aromatic fashions made great inroads on his numbers. His habit of stopping to look back at an enemy, after making a few enormous leaps in flight, allows the hunter to get in the fatal shot.

The musk deer is also easily snared by taking advantage of his tendency to follow obstructions. Native trappers construct a low brush fence in which openings are left at intervals of 100 to 150 yards. On the ground in each gap is placed a noose, connected to a springy bent sapling in such a way that an animal stepping into the snare will disengage the sapling and be suddenly lifted into the air by a leg.

The globular musk gland, located in the skin of the middle of the male's abdomen, is removed entire and dried. The contents weigh about an ounce, although this varies with the season of the year and age of the animal.

Indian Muntjac

Muntiacus muntjak

The lonely little Indian muntjac trots through the jungle with a very faint, odd clicking sound (Plate XIV). When excited, he will give a series of loud staccato barks, like a dog, which has given rise to the popular name of "barking deer." His clamor is astonishingly noisy for his half-pint size, but, unless trailed, he will continue yelping until the cause of his agitation has ceased.

Europeans stationed in India and points to the east in southern Asia consider the muntjac a high test of hunting skill. Living in thick jungle, he emerges to the woody borders or clearings only to graze and browse. The novice hunters never see this quarry, for he knows when to be silent. Keeping ahead of the pursuers' noisy, floundering progress in the dense thickets, he moves easily and stealthily with his head much lower than his hindquarters. If unsportsmanlike methods of hunting, such as running with dogs, are not employed, the muntjacs will live long and multiply.

This elusive animal, when finally captured, proves to be an amazing creature. Two dark riblike lines start above his nostrils and run up the face and the front of the extraordinarily long pedicles, or antler stalks. These bony, hair-covered spikes, about four inches long, are topped by brief horns that are usually even shorter than their supports. As if in recompense for these trifling antlers, Nature has given the muntjac an excellent pair of tusks with which he can inflict severe wounds.

The doe has neither tusks nor antlers, and in place of the pedicles she wears tufts of bristly hair which terminate the face lines. These latter rib marks on both sexes, which look like the painted daubings of an American Indian warrior, have conjured up another popular name of "rib-faced deer."

About 20 inches high, the little muntjac weighs scarcely 40 pounds. His ears are oval-pointed and his feet small. He wears a coarse, smooth coat of reddish brown that becomes paler on the belly and white on the hindquarters, chin, and throat.

Although in southern India muntjacs mate at various times of the year, in the northern latitudes most of them prefer January and February as the period for courtship. At that time the bucks become bold. They walk about quickly, lifting their legs in a curiously deliberate fashion. Rivals for the does fight fiercely, using the long upper canine teeth rather than the diminutive horns. At this time they are especially vociferous and persistent in their barking.

After mating, the animals return to their normally solitary ways. About six months later the doe gives birth to one or two spotted fawns. Her very long and extensile tongue is especially adapted for washing the babies and is supposed to be long enough to reach entirely over her own face. When feeding, she uses it to wrap around a twig, stripping off the leaves and pulling them into her mouth.

Muntjacs of other varieties are found outside India, through Burma, the Malay Peninsula, Siam (Thailand), Java, Sumatra, and Borneo. They vary from bright chestnut to tawny,

TO FIGHT OFF AN EAGLE, AN HIMALAYAN DEER DEFENDS ON CANINE TUSKS

The little **Musk Deer** has no antlers. Base for many perfumes is the musk secreted in a sac under the male's abdominal skin. Thick, coarse hair protects it from the cold of high altitudes.

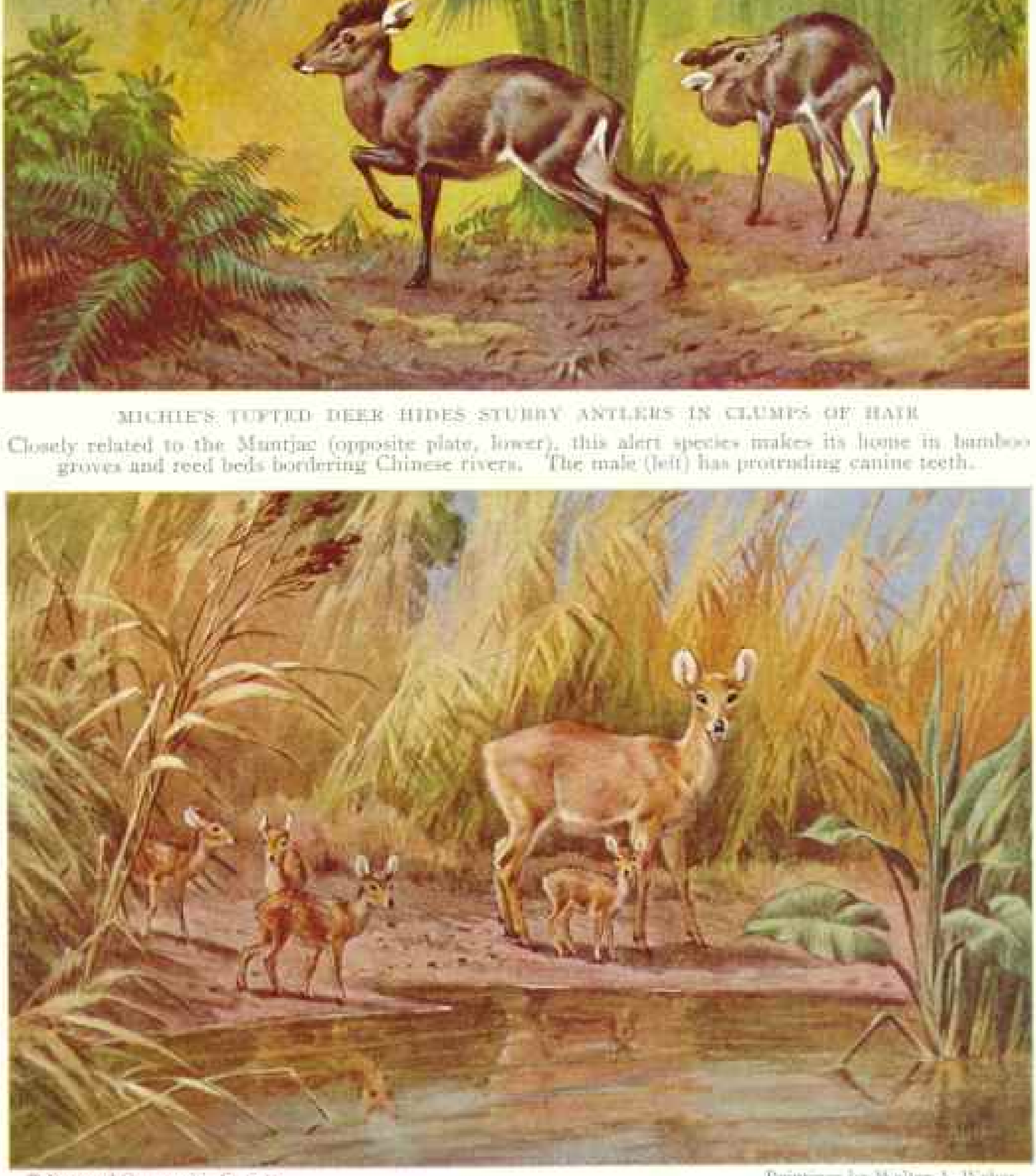
 Paintings by Walter A. Weber

WITH VOICE AND TROT LIKE A DOG'S, HE IS DUBBED "BARKING DEER"

Shy and wary, the small **Indian Muntjac** clings to the cover of dense jungle. The buck (left) has two long upper fangs. Short antlers rise from hair-covered bony stalks.

MICHIE'S TUFTED DEER HIDES STUBBY ANTLERS IN CLUMPS OF HAIR

Closely related to the Muntjac (opposite plate, lower), this alert species makes its home in bamboo groves and reed beds bordering Chinese rivers. The male (left) has protruding canine teeth.



Paintings by Walter A. Weber

WITH CHINESE WATER DEER, A "LITTER" OF FAWNS IS THE RULE

This race is less than two feet tall. From the shelter of reeds and high grass it often takes to the water. Neither sex carries antlers, but the buck is armed with long tusks.

Photograph by Richard H. Stewart

IT LOOKS LIKE LOVE—BUT IT'S ONLY HUNGER

Old Bill, a pet buck mule deer at the Grand Canyon, steals a tempting morsel from between a friend's teeth. His antlers, although almost full-grown, still are sheathed in the protective velvet. The youth is taking a chance, because no adult deer can be trusted.

Michie's Tufted Deer

Elaphodus elaphodus

Laymen often poke fun at specialists for conferring apparently ill-suited names on animals. With the title of the tufted deer, however, no fault can be found (Plate XV). The long black hairs rising from his forehead form the most conspicuous feature of this little creature, which is only 22 to 23 inches high. His antlers are mere apologies for weapons. Scarcely more than an inch long, these puny spikes do not even protrude above the crown hair tufts. Fortunately, he has been given long saberlike teeth to help him win his battles.

Although closely related to the Indian muntjacs in general conformation and proportions, the tufted deer are heavier, much shaggier, with wider ears.

Of the two known races, only one, Michie's tufted deer, is illustrated. His coarse body hairs are whitish with brown tips, the resultant effect being a brownish "pepper-and-salt" color, darkest on the legs and center line of the back. The speckling is especially pronounced in front, on the chest, neck, and head. Fawns are much like their parents in color, with the addition along the back of two or four rows of indistinct white spots which disappear as they grow older.

Michie's deer range over central and southern China. Always associated with water, they are abundant in the reeds bordering the rivers.

The other race, the Tibetan tufted deer, is quite similar to Michie's, except that the animals are darker and are speckled only in front of the shoulders. They are limited in distribution to eastern Tibet, one of the least-known areas on the globe, and there is no information about their life history or habits.

Chinese Water Deer

Hydropotes inermis

Relatively defenseless animals generally have large and frequent litters of young, for only in this way can a high mortality rate be offset and perpetuation of the species be assured. Thus rabbits and mice have as many as a half-dozen litters in a season, of eight or more babies at each birth.

Deer were once in similar need of a high birth rate, for they were small creatures, hardly larger than cats, and continually preyed upon by their carnivorous superiors. As they developed size, speed, and senses to detect danger, the rate of survival increased. Large families then became a handicap because many hungry mouths made a scarcity of food. Their evolution brought a change in birth rate. Today most members of the deer tribe have usually one fawn at a birth, and rarely more than twins.

Photograph courtesy U. S. Department of the Interior

GREEN LEAVES AU NATUREL ARE A FAVORITE FOOD WITH THE MULE DEER

In California's Sequoia National Park a doe half-climbs a manzanita bush to browse upon its foliage. Mosses, lichens, twigs, and grass round out the menu of this species.

The Chinese water deer is regarded as an ancient type, for, less than two feet high, the mother produces from three to as many as six or even more fawns at a time (Plate XV). The youngsters are faintly spotted with white in lines running "fore and aft" from the neck to the tail. The parents have a coarse, hard pelage, light rufous chestnut in color, stippled with blackish; and the underparts, throat, chin, and sides of muzzle, are white.

Neither parent has antlers (another sign of antiquity of the species), but both have formidable tusks for defence of themselves and family. The buck's canines are somewhat larger than his mate's and are slightly convergent. The species is found only in northeastern China and Chosen (Korea).

These water deer are well named, for they live in the reeds bordering rivers and lakes, where they feed on grasses and sedges. Rather sociable, they are found in small groups of two or three adults with their numerous progeny. The hardy hunter who tries to find them in this thick cover may set them to flight in quick, short leaps much like those of a hare. After running for a short distance, they suddenly drop again into the rushes.

Rusa

Cervus hippelaphus

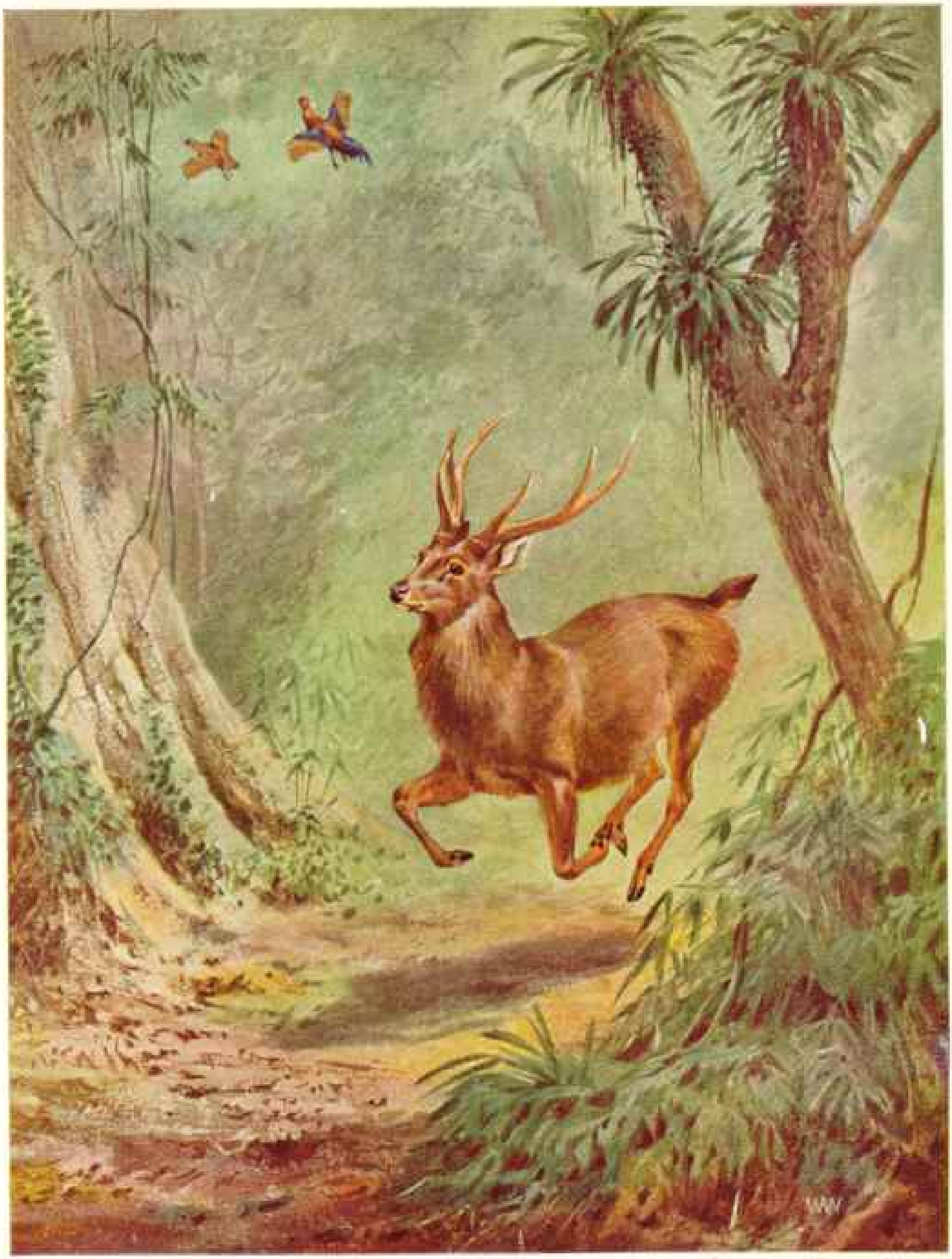
Rusa, the Malayan word for deer, is applied to this handsome creature of Java, Borneo, and the Moluccan Islands (Plate XVI). On those fragments of land that splatter the South Sea east to New Guinea, we find a similar but smaller deer. The more formal systematists believe that they are a related, though separate race from the Javan animal. Other zoologists, however, remind us that the Malayans have loved animals from time immemorial and have caught, tamed, and taken them on sea voyages from island to island in their big canoes.

In this way the island deer may be descendants, many times removed, of the rusa of Java. At any rate, they lack the impressive mane so well developed on the throat and neck of the Javanese male rusa, are not so "rangy" in form, and carry smaller antlers.

About four feet high at the shoulder, the size of a red deer, the rusa in summer is a dark, grizzled ochraceous brown with a tinge of red, darker on the hindquarters. In winter the coat becomes more grayish.

The antlers are rather slender for such a large animal and closely follow the same regular form even though many heads are compared. They are all three-tined, the pair enclosing a lyre-shaped space.

Little is recorded of the habits of these deer. In Borneo they are hunted with dogs, driven into a ring formed by native hunters, and killed with spears. The meat is then smoked and brought into the villages.



 Painting by Walter A. Weber

JUNGLE FOWL WHIR AWAY AS A FLEEING RUSA STAG GALLOPS PAST

Hunters and dogs have started a big **Rusa,** named from the Malayan word for deer. Many races of this deer dwell throughout southeastern Asia and Netherlands Indies. They vary in size and shading, but all carry graceful three-tined antlers and usually have long shaggy manes. Animal-loving aborigines may long ago have carried this animal in their canoes to distant islands that had no native deer.

WE KEEP HOUSE ON AN ACTIVE VOLCANO

After Flying to Study a Spectacular Eruption in Belgian Congo, a Geologist Settles Down on a Newborn Craterless Vent for Eight Months' Study

By Dr. Jean Verhoogen

University of Brussels

EARLY in February, 1938, news came through to Belgium that an eruption had started at the volcano Nyamlagira in the Albert National Park, Kivu District, Belgian Congo.

The watchful superintendent of the park, who had been observing the volcano for many years, had predicted the eruption for early in 1938. His predictions were fulfilled on January 28, when the volcano erupted in an extraordinary manner.

A number of huge fissures opened on the southeastern and southwestern flanks of the mountain, a deluge of lava poured out, rushed down at terrific speed, set hundreds of square miles of forest on fire, and trapped large numbers of antelope which were later found completely carbonized.

Tremendous founderings occurred in the crater as a result of the drainage of lava through the fissures. The pools collapsed into a deep chimney, and the crater presented a scene worthy of Milton's description of Chaos in *Paradise Lost*.

The superintendent was at the crater of the volcano at the time of the eruption. He had seen the beginning and had sent reports which indicated the eruption was unusual, scientifically interesting, and spectacular (page 526).

Geologists, If Not Laymen, Welcome Volcanic Eruptions

Geologists welcome news of a volcanic eruption, as it affords them a chance to gain information concerning the processes active inside our earth. An opportunity as good as this could not be missed.

The University of Brussels (Cassel Fund) decided to co-operate with the National Park Institute and offered me the opportunity of flying to the park to study the eruption.

The idea of a volcanological investigation at Nyamlagira had been my dream for many years before the eruption; consequently, I knew fairly well how I wished to plan for such an undertaking.

It is one thing, however, to prepare leisurely for an expedition with plenty of time ahead; and another to be thrust into an airplane bound for mid-Africa, with an allowance of exactly 200 pounds of luggage, oneself included.

I remember little of those three days in the air from Marseille to Port Bell, Uganda. Weather was bad and we flew rather high all the way. In the intervals between considering air sickness as much more than a remote possibility, my thoughts were occupied mainly with the volcano.

For all I knew, the eruption might have stopped by that time, or the volcano might object to my intrusion. In either event, there would be no use en route for the new camera which was traveling under heavy seals in a separate compartment, since Italy and Greece were then forbidden lands for amateur aerial photographers.

To the Equator, With Warm Clothes

Having been warned of the cold weather that usually prevails at high altitude on the volcano, I was carrying warm and thick clothes with me.

I realize they probably looked a bit comic in Khartoum, but they came in handy on the volcano where the temperature, in spite of the glowing lava, would commonly drop to a mere 41° F., which, for an erupting volcano right under the Equator, is admittedly very low.

When I got off the plane at Port Bell, on Lake Victoria, however, I indulged in a few shirts which looked more like the local style than did my heavy camel's-hair coat worn from Europe.

The distance from Lake Victoria to the Albert National Park in the Belgian Congo is just a long day's ride (map, page 515).

The headquarters of the park are located at Rutshuru, halfway between Lake Edward and Lake Kivu, some 22 miles northeast of Nyamlagira.

Photograph by Randolph A. Christie

HEADSTRONG!

A Wakutu tribesman of Ruanda, Belgian Congo. His forebears years ago were subjugated by the tall Watussi (Batussi), when those warriors invaded the Wakutu homeland from the north. Pygmies form a third tribal group in this province.

Necessary camping equipment was obtained there, and porters were recruited in sufficient number to carry the indescribable jumble of pots and pans, chairs and tables, beds and tents, chickens and bananas, which make up any well-organized safari. From the road to the top of Nyamlagira constitutes a two days' hike. The climb is exceedingly easy, as the slopes of the volcano are in no place very steep.

Nyamlagira, 10,026 feet above sea level, is the westernmost of the Virunga volcanoes. The Virunga volcanic range, north of Lake Kivu (pages 518-9), is one of the youngest features, geologically speaking, of the African Continent. This group of eight huge volcanoes rises from the floor of, and stretches across, the Western Rift Valley, about 1° 30′ south of the Equator (page 514).

THE COLOSSAL RIFT VALLEY

The Western Rift Valley is a branch of the Great Rift Valley, that narrow, sunken area which, cutting across the highest land along its course, extends from Mozambique up through East Africa and along the Red Sea into northern Syria. In the Dead Sea its floor is below sea level; whereas its walls rise in places to 10,000 feet, or more.

Geographically and geologically speaking, the Great Rift Valley is one of the most important and prominent features of the face of the earth. The Western Rift Valley, 850 miles long, contains Lake Tanganyika, one of the deepest lakes in the world, with a bottom 1,600 feet below sea level, the basins of Lakes Kivu, Edward, and Albert, and also includes sections of the Nile Valley.

THESE VOLCANOES MERE YOUTHS

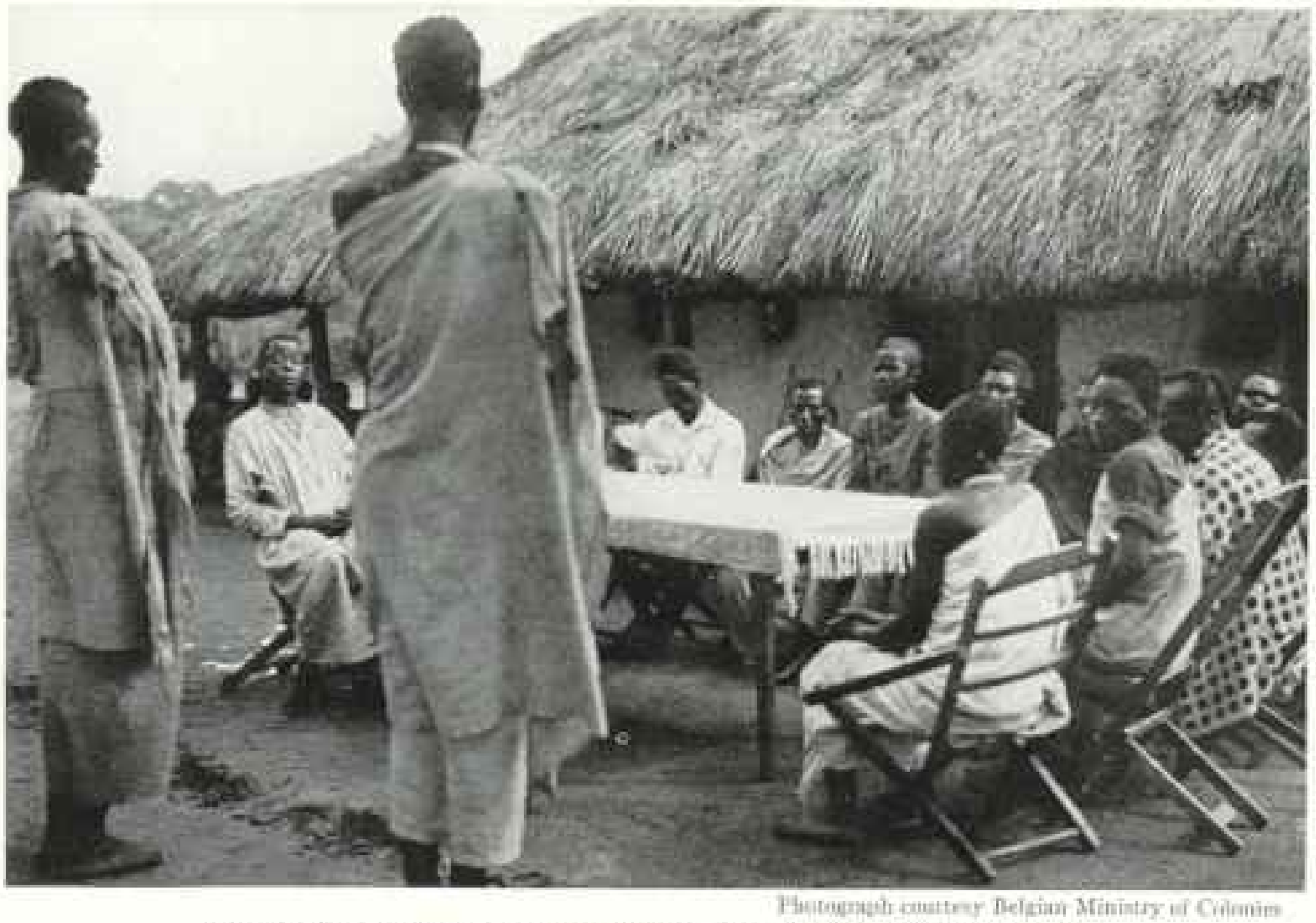
It is not known exactly when volcanic activity began in the Virunga group ("Virunga"—Volcano). There are many indications, however, that most of the volcanoes are not very old; they may, indeed, be contemporaneous with man. There is good evidence that in times not far back Lake Tanganyika was flowing northward towards Lake Edward and the Nile. Neither Lake Kivu nor the volcanoes existed at that time.

Then tremendous movements occurred, and volcanic activity was initiated. As a result of this activity, a river flowing northward was dammed behind a rising wall of lava, thus bringing into existence Lake

Photograph by Jean Verhoogen

ON SAFARI TO THE VOLCANOES, THE AUTHOR PUTS UP FOR THE NIGHT

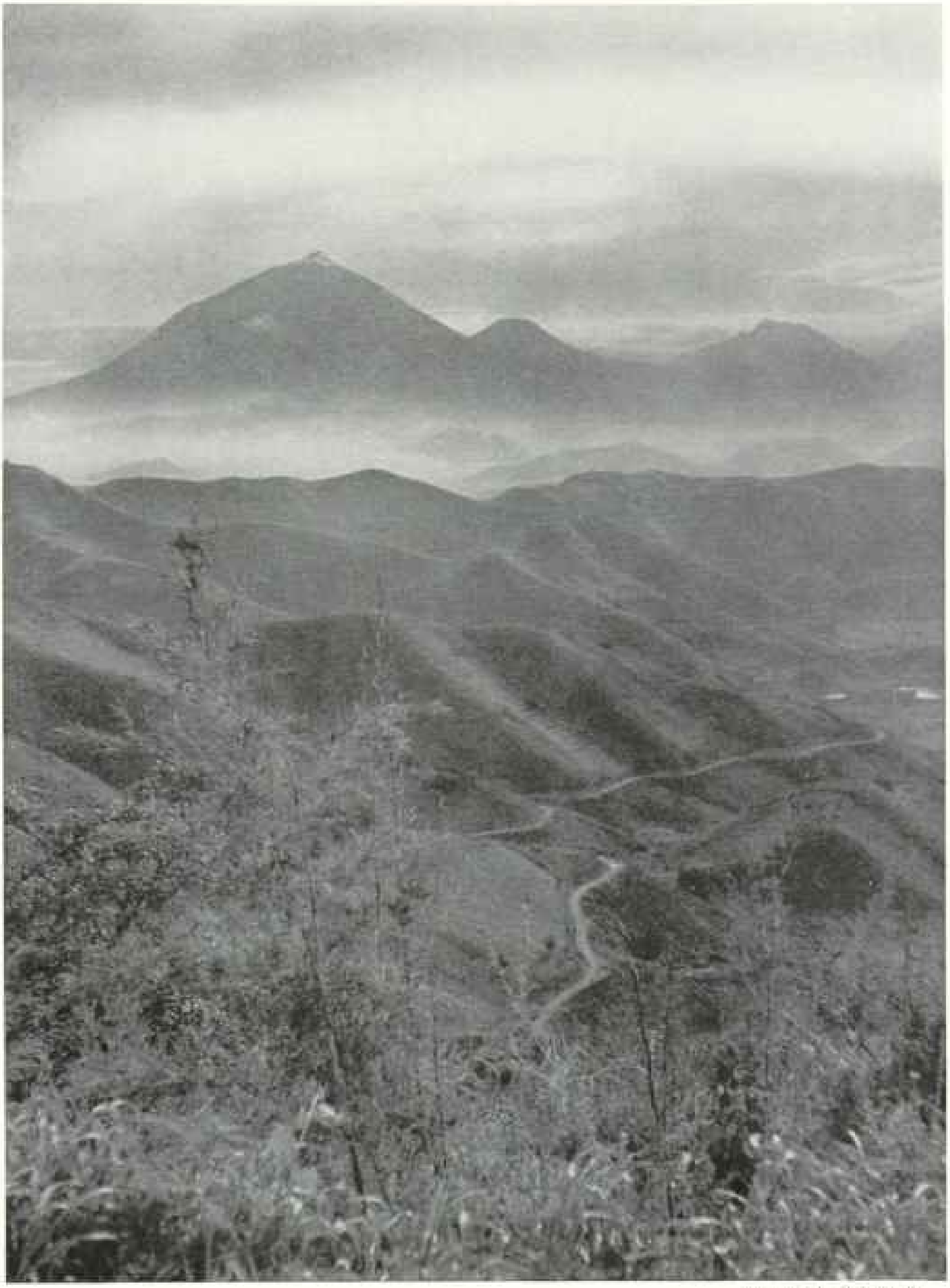
From Rutshuru, headquarters of Albert National Park in the Belgian Congo, Dr. Verhoogen set out for Mount Nyamlagira, some 22 miles to the southwest, or 30 miles by road. Porters carried furnishings to equip a camp on the side of the seething inferno. The hike from the main road to the 10,026-foot peak through wilderness took two days.



Photograph courtesy Belgian Ministry of Colonies

TRIBESMEN CONFER WITH THEIR CHIEFTAIN AT RUTSHURU

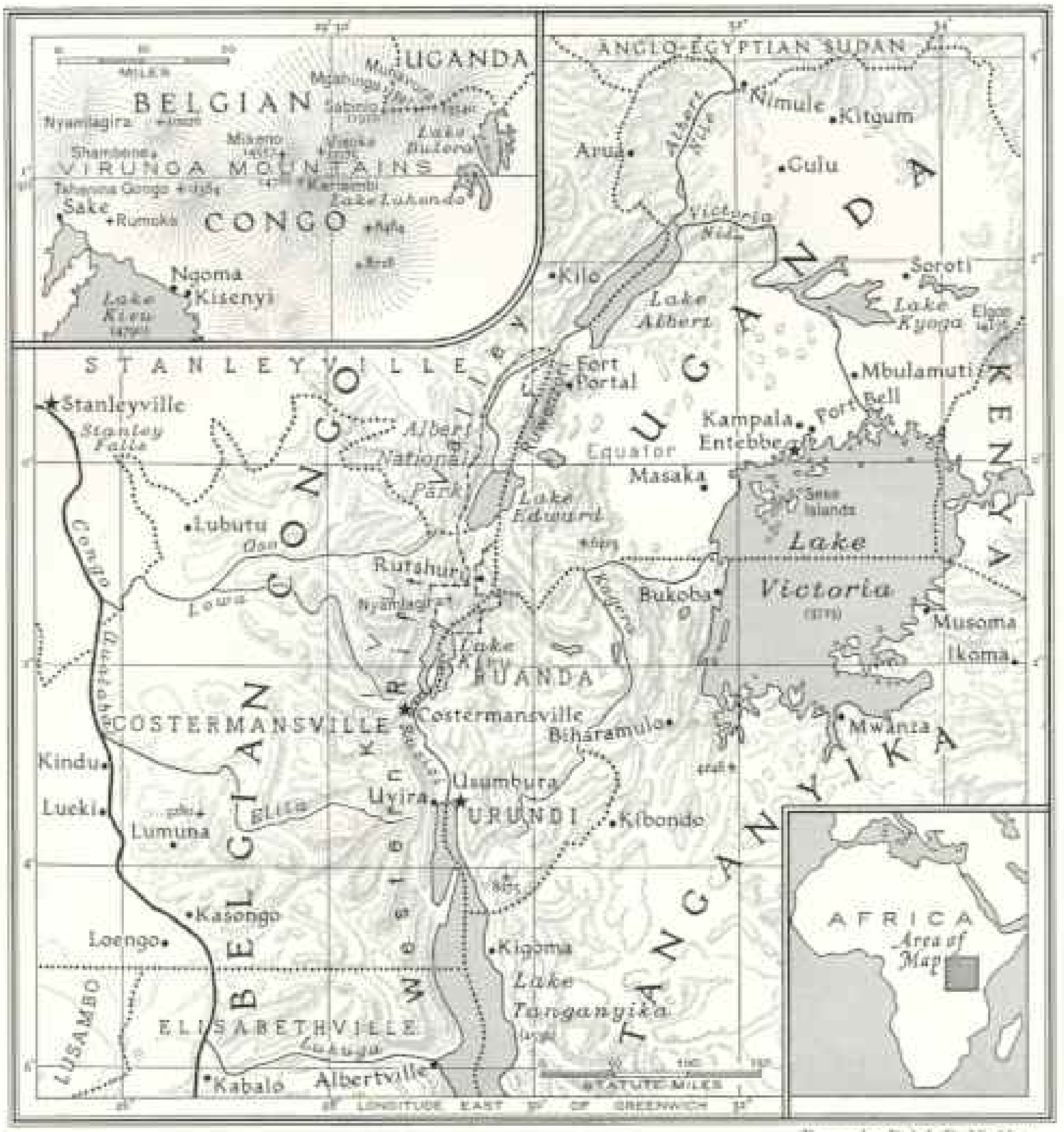
Aristocrats of the clan wear silken togas. Their meeting place is in the "capital" of Albert National Park, eastern Belgian Congo. This preserve of 3,300 square miles, in the Western Rift Valley (page 512), embraces the Virunga Mountains and part of Lake Edward, and extends to Lake Kivu.



Photograph by F. J. Ertoll

RUANDA NATIVES CALLED THIS ROW OF VOLCANIC PEAKS "THE KITCHEN"

The mighty Virunga Mountains, also known as the Mufumbiros, in the Western Rift Valley, were explored by the American sculptor, Carl Akeley. Here in the forests of Kivu District he found gorillas, elephants, and many other wild animals. Here he also made friends with the Pygmies and taller tribesmen (page 512). The explorer's ashes rest on the slopes of Mount Mikeno, an eminence in the Virunga range.



Drawn by Ralph E. McAleer

MOUNT NYAMLAGIRA, ERUPTING WITH PENT-UP FURY, SHOWERS SEETHING LAVA INTO THE HEART OF AFRICA'S BIG GAME COUNTRY

The 10,026-foot peak, westernmost of the eight huge volcanoes that make up the Virunga range, rises from the floor of the Western Rift Valley, about 100 miles south of the Equator. Gorillas, elephants, antelopes, and a host of other wild creatures inhabit the forests of this area, a part of Albert National Park, vast natural reserve of the Belgian Congo. The upper inset shows in detail the area affected by the flow of molten lava. The lower inset shows Nyamlagira's relative position on the African Continent.

Kivu. Its waters were soon thrown back southward towards Lake Tanganyika, which had to seek a new outlet for itself.

Now its waters, and those of Lake Kivu, run west through the Lukuga River into the Congo Basin. The Congo-Nile Divide, of which the Virunga range is a part, was thus displaced for many miles to the north.

One can well imagine how disturbing an event the birth of a volcanic range may be. As the volcanoes rose higher and higher, the lavas spread ever farther, extending south and north and piling up against the walls of the Rift Valley.

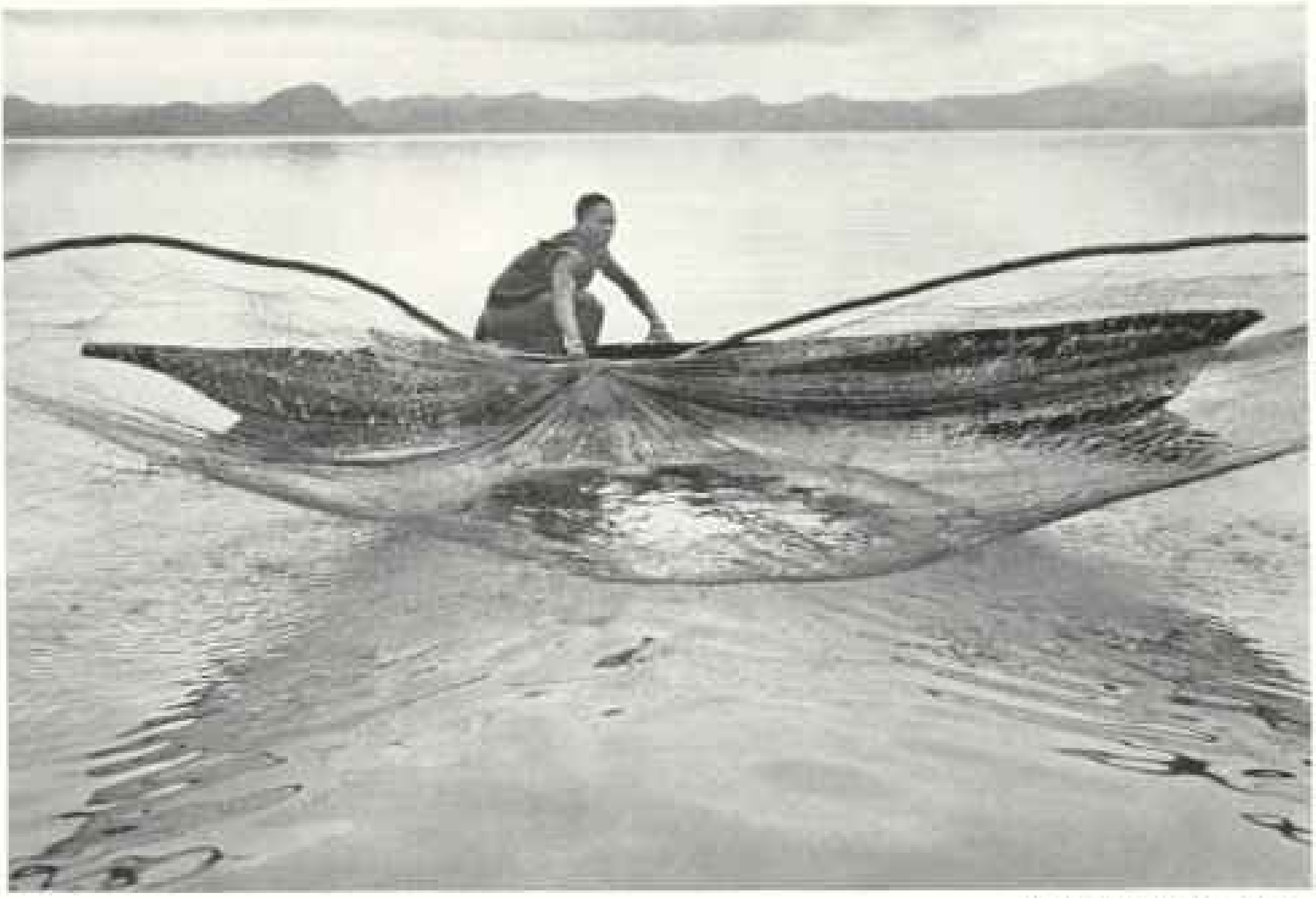
BIRTH OF A VOLCANIC RANGE IS A DISTURBING EVENT

Mountains were born which now rise more than 14,000 feet, towering a good 11,000 feet above the floor of the valley.

Photograph by Jean Verhoogen

LAVA SHEETS BUILD UP A TORTOISE-SHELL BACK FOR NYAMLAGIRA

The lava, exceedingly fluid, spreads out thinly. The sheets pile up on each other as they cool, assuming a peculiar shape. This type is known to geologists as a "shield volcano" (page 520).



Photograph by G. Michel

A ONE-MAN "BUTTERFLY NET" BRINGS IN PLENTY OF FISH ON LAKE KIVU

Suddenly applying pressure on the ends of the two poles, the fisherman raises the submerged net in a jiffy, trapping all the fish between the mesh and the surface of the water.

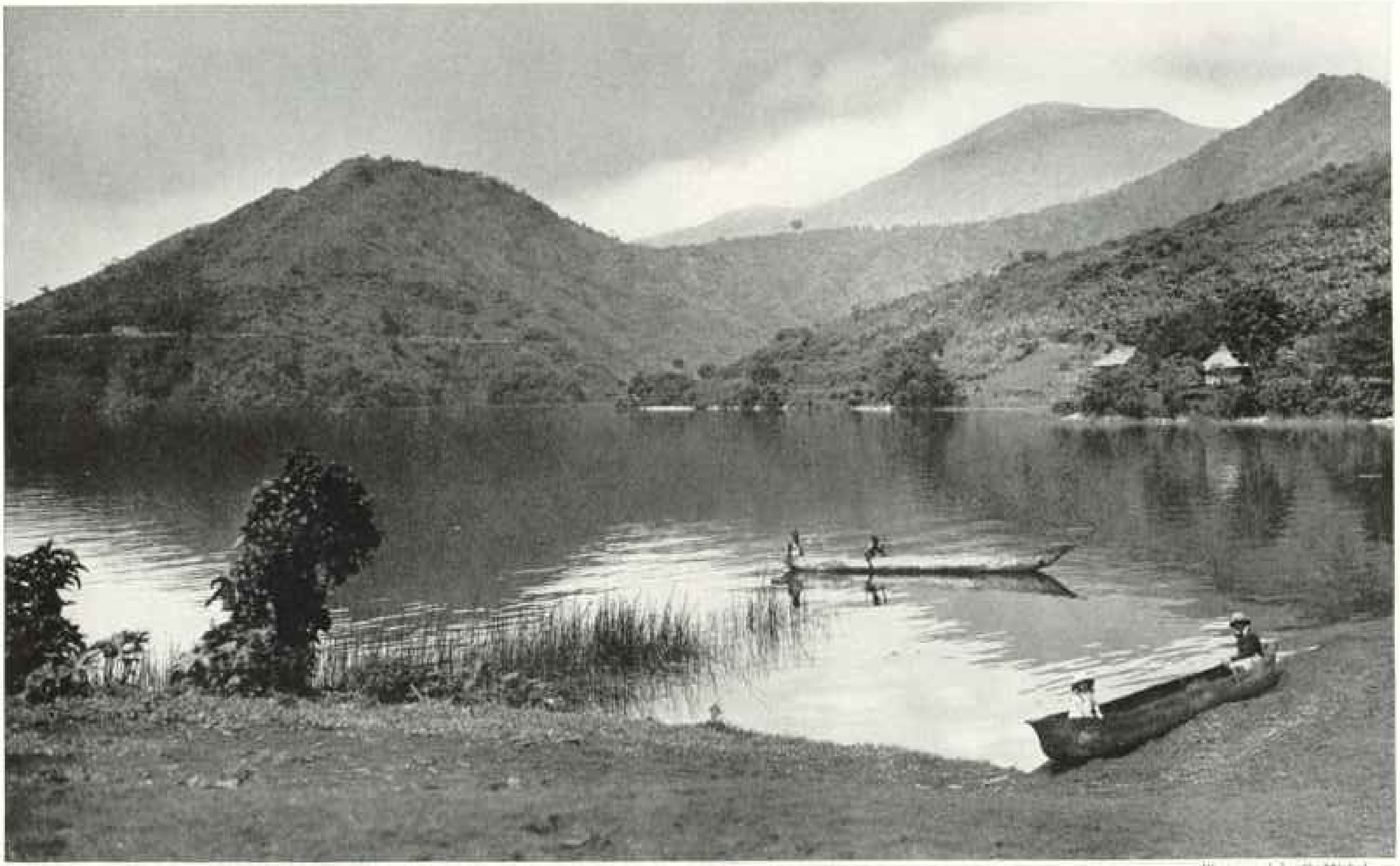
SHAMBENE SMOKES AND GLOWS AT THE FOOT OF NYAMLAGIRA

From the edge of the tall mountain's crater the author made this photograph of the new volcano, bursting forth at the base of the old (page 526).

Photographs by Jean Verhoogen

SHADES OF NIGHT FALL UPON SHAMBENE

Yellow flames are visible at the mouth of the cones. Clouds of smoke reflect the glow from the incandescent lava. The lava "river" wriggles down into the plains.



Photograph by G. Michel

IN THE DIM PAST, HUGE WALLS OF LAVA ROSE TO DAM UP LAKE KIVU

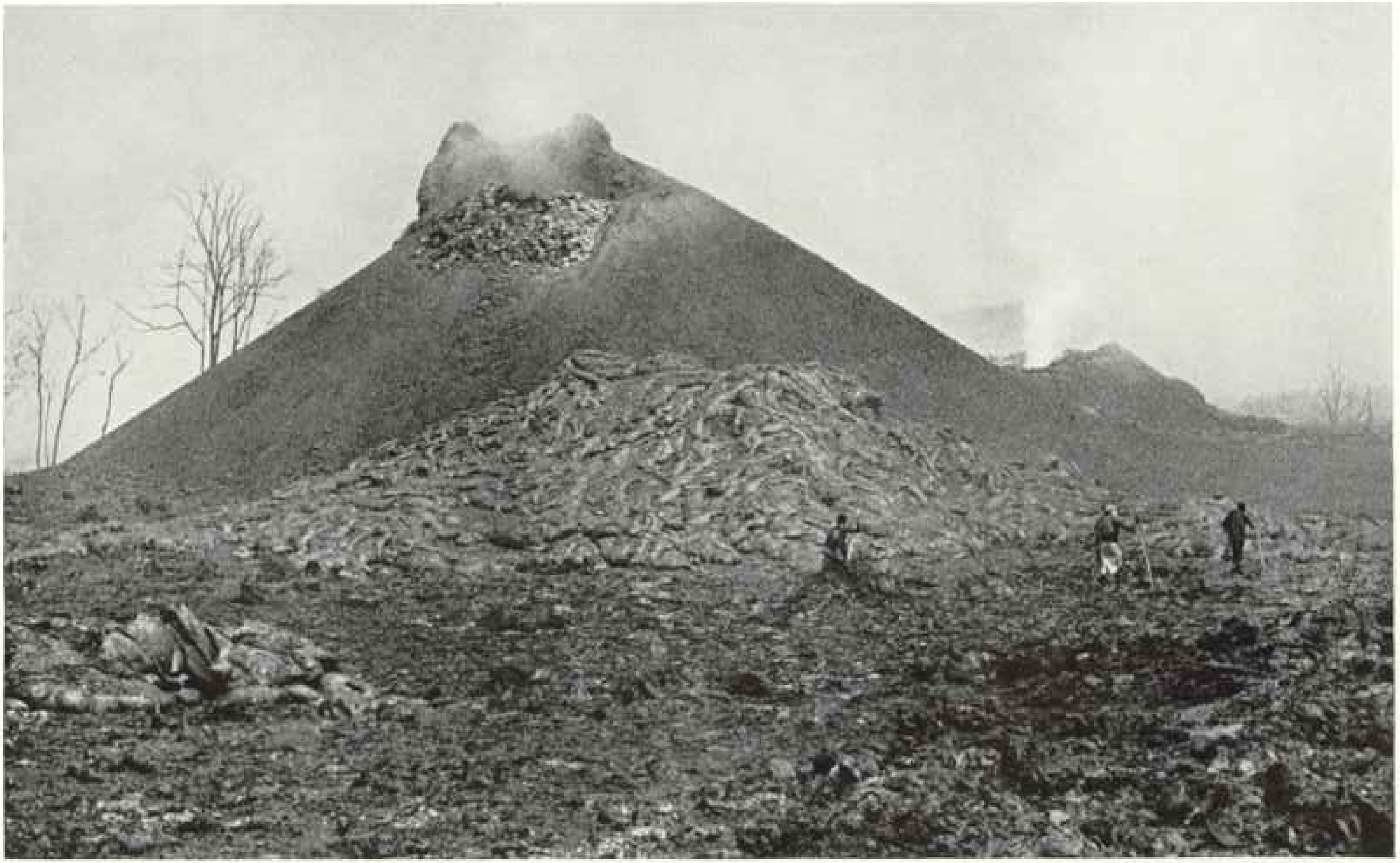
The lovely, mountain-locked sheet of water, 4,800 feet above sea level in the Western Rift Valley, has been likened by some travelers to the Bay of Naples. North of the lake lie the Virunga (volcano) Mountains.

DUGOUTS TRAVERSE ALMOST-BOILING WATER, WHERE HOT LAVA FLOWS INTO LAKE KIVU

Steam rises from the surface, which is covered with an oily, black scum. On shore, vegetation succumbs to the molten streams.

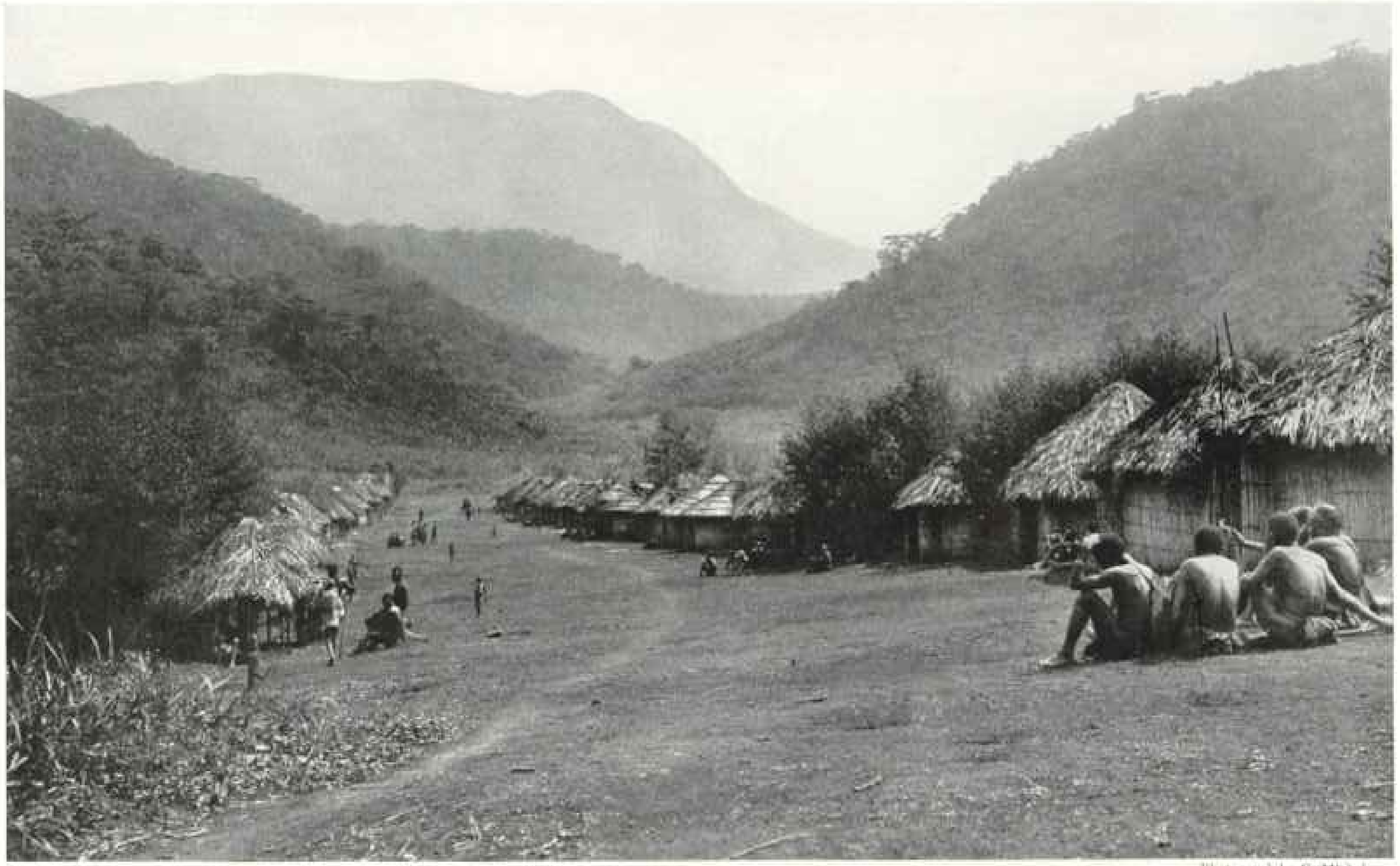
Photographs © Captain C. R. S. Pitman

STEAM, SMOKE, AND LAVA SPREAD OVER THE TWO-MILE-WIDE CRATER AT NYAMLAGIRA'S SUMMIT



SPOUTING SULPHUR CHIMNEYS RESEMBLE MINIATURE VOLCANOES

Steaming fumes shoot from the cones, some of which rise to a height of 60 feet on erupting Nyamlagira. About their steep sides lie congealed masses of twisty and curly melted lava.



Photograph by G. Michel

EVERY DAY IS HALF-HOLIDAY FOR VILLAGERS IN THE KIVU LAKE REGION

Back of the thatch-roofed houses lie the fields, where these African tribesmen worked until midday. Now they are whiling away the afternoon hours in languid conversation. Being out of the path of flowing lava, villagers showed little interest in the eruption of Nyamlagira.

Photograph by G. Michel

"HOTEL OF THE VOLCANOES" ON LAKE KIVU COMMANDS A VIEW OF SOARING CONES

The modern hostelry in Ngoma, at the northeastern corner of the lake, is headquarters for many travelers who come to see the volcanic regions to the north. Near by is the prosperous settlement of Kisenyi, in the territory of Ruanda-Urundi, since the World War under mandate of Belgium, and once a part of German East Africa. The territory is administered as a part of the Belgian Congo.

Photograph by G. Michel

BELGIAN ENGINEERS TRANSFORM A HAZARDOUS MOUNTAIN TRAIL INTO A MODERN HIGHWAY

Between Sake and Costermansville a new road, opened a little more than a year ago, pierces the heart of the Kivu mountains for a stretch of more than 100 miles. It is so narrow that northbound and southbound traffic must use it on alternate days.

Photograph by G. Michel

BABY NAPS ON MOTHER'S BACK AS SHE WORKS IN THE FIELDS

Only a slender leg reveals the presence of a shy little boy behind the woman in foreground, who is wielding a wooden hoe. Men in the Kivu District of the Belgian Congo take no part in tilling the soil. Their duties are done after they have cut down the trees and cleared out the brush, reclaiming the land for cultivation.

They acted as an effective barrier to the invasion of the cattle-owning Batussi people, who settled on the southern slopes and never crossed the mountains.

As a result, utterly different conditions, both economic and social, were established on either side of the range.

LAVA ACTS AS FERTILIZER

Changes in the topography have wrought changes in the climate. From the sultry plains to the everlasting fogs on the mountains the variety is extreme and has resulted in incredibly different types of vegetation, some of which would have been utterly unknown in the region except for volcanic action.

A new habitat was created for man. Cattle settled on the lower slopes of the mountains; and in the extinct craters, filled now with fertile soil, native villages emerged in the midst of beans and bananas.

Because of their high potash content, the lavas acted as fertilizers, yielding, after a few centuries, wonderful soils on which vegetation develops rapidly. Instead of the meager, desiccated, and thorny bush that covers sparingly the floor of the valley, the slopes of the range are filled with lush vegetation and luxuriant forest, a favorite haunt of elephants and leopards.

BAMBOOS AND GORILLAS

Higher up on the mountains groves of bamboos are evident, as are also numerous gorillas, thriving within the protection of the boundaries of the Albert National Park. Beyond the bamboo forest and the *Ha-*

Photograph by G. Michel

HOMEMADE CANOES PLY LAKE KIVU WITH PRODUCE FOR SAKE'S MARKET

Tribesmen row their dugouts, laden with fruit and vegetables, across the mirror surface of the lake from their hamlets to the settlement. In Sake they bargain with Hindu merchants for cheap cotton goods and imported foodstuffs.

genia abyssinica, or paperbark tree, at timber line, one enters the fascinating region where vegetation resembles nothing that one has ever seen except, perhaps, in dreams of the moon.

Struggling up through giant groundsel and candlelike lobelias, 12 or 15 feet high, one reaches a zone where vegetation is scarce and snow not infrequent (pages 546 and 549).

Up to the very summit of the less accessible peaks—all of them extinct volcanoes of which nothing is left to remind the climber that they were once mountains of fire—life remains abundant and indomitable.

In the topmost regions birds, beetles, and the klipspringer, *Oreotragus oreotragus*, a mountain antelope, carry on a successful struggle for existence.

Volcanic activity has thus created a new world of its own, enclosed by and restricted to the mountains themselves.

VOLCANOES STILL AT WORK

The work of the volcanoes is by no means completed yet. The two westernmost volcanoes, Tshanina Gongo, or Nira Gongo, and Nyamlagira are still very much alive. Numerous eruptions have been recorded in this region, the latest of which occurred in 1912, when a new volcano was formed a few miles north of Lake Kivu.

This one, Rumoka by name, remained active for several weeks. Its lavas, running down to the lake, almost completely filled up a strait between two promontories, practically cutting off a bay from the main lake.

Of these two volcanoes, Nyamlagira, the object of my special study, is a very peculiar

one. It closely resembles Hawaii's Kilauea, which belongs to a distinctive type (Hawaiian type) of volcano, of which very few, if any, other examples are known to be active at the present time.*

Considering the geological and geographical differences between Hawaii and the Kivu region, it is very surprising indeed that such a degree of similarity could be attained in spite of these divergences of prevalent conditions.

Hawaii, of course, is a central Pacific island of a group lost in the midst of an ocean which is one of the greatest and most nearly permanent features of the earth. Nyamlagira, on the contrary, is located on the very backbone of the African Continent, one of the most ancient, lasting, and "continental" of all continents.

These facts alone may serve to prove that volcanic activity has very little to do with geographical conditions. Sea or land, ocean or continent, mountains or plains, plateaus or rift valleys, from one pole to the other volcanoes may burst forth regardless of geographic environment.

A HAWAIIAN VOLCANO TYPE

As I have stated, Nyamlagira shows the attributes of a Hawaiian volcano. Just what are the distinctive features of this volcanic type? First of all, the lava is usually exceedingly fluid. It flows almost like water, spreading out as thin sheets over vast areas.

The volcano which is built up as a result of these sheets piling on top of each other assumes a peculiar shape, a form more like a tortoise shell or a shield than a true volcano. In fact, these volcanoes are known geologically as "shield volcanoes" (page 516).

AFFORDS FANTASTIC SPECTACLE

Their most peculiar feature is perhaps the uncanny manner in which they manage to remain active for months or years without spilling a single ounce of lava.

The lava remains dammed up in pools, or lakes, in the crater. It is very hot (lava, of course, is molten rock at a temperature around, say, 2,000° F.) and would cool down rapidly and become solid were it not for a most ingenious circulatory system which keeps it in motion all the time.

The lava, when it begins to stiffen and congeal, is drawn aside under one bank of the lava lake, sinks down to some unknown depth, becomes reheated and, by some process or other, turns upward again and reenters the lake from one side.

NATURE'S INGENIOUS LAVA PERCOLATOR

The pasty mass of molten rock is thus maintained in a state of constant agitation. Gases, which rise to the surface of the lava as big splashing bubbles, burn with a beautiful yellowish-green tinge. At night the lake becomes a fantastic scene of bright, incandescent lava, which appears to be boiling in the midst of phosphorescent flames.

Nyamlagira had displayed activity of this kind for many years previous to the 1938 eruption.

Several lava pools located inside the main crater, two miles wide, displayed the typical features of Hawaiian activity. They would occasionally overflow, and a thin flow of lava would spread over the floor of the crater. In this manner the crater was slowly becoming filled.

It soon became clear that when it would be full to level, the lava would overflow and spread out on the slopes, and a true eruption would occur.

THE BIRTH OF A VOLCANO

It did, as stated, on January 28, 1938, and about the time of the eruption I have described (page 511), an explosion occurred at the foot of the mountain at a place called Shambene.

A new volcano was born!

This new volcano was peculiar. It lacked one of the essential characteristics of a volcano—a crater.

Otherwise it possessed many features of unusual type which any volcano would be proud to own (page 517).

There was a lava lake, one of those rare lava lakes which delight scientists; there was a lava stream, an actual river of lava issuing from the ground at the foot of a cliff and flowing down leisurely like any ordinary stream of water; and there were also a number of cones and gas vents, mounds some 50 feet in height from which

* See, in the NATIONAL GEOGRAPHIC MAGAZINE, "Hawaiian Islands: America's Strongest Outpost of Defense—The Volcanic and Floral Wonderland of the World," by Gilbert Grosvenor, February, 1924; "Hawaii, Then and Now," by William R. Castle, October, 1938; and "Bird Life Among Lava Rock and Coral Sand," by Alexander Wetmore, July, 1925.

SABLE ANTELOPES MADLY FLEE A STRANGE PURSUER FROM OUT THE SKIES

Close on their heels the shadow of the photographer's plane rushes relentlessly. The wary sprinters were surprised while grazing on the Gorongosa Plains of Mozambique.

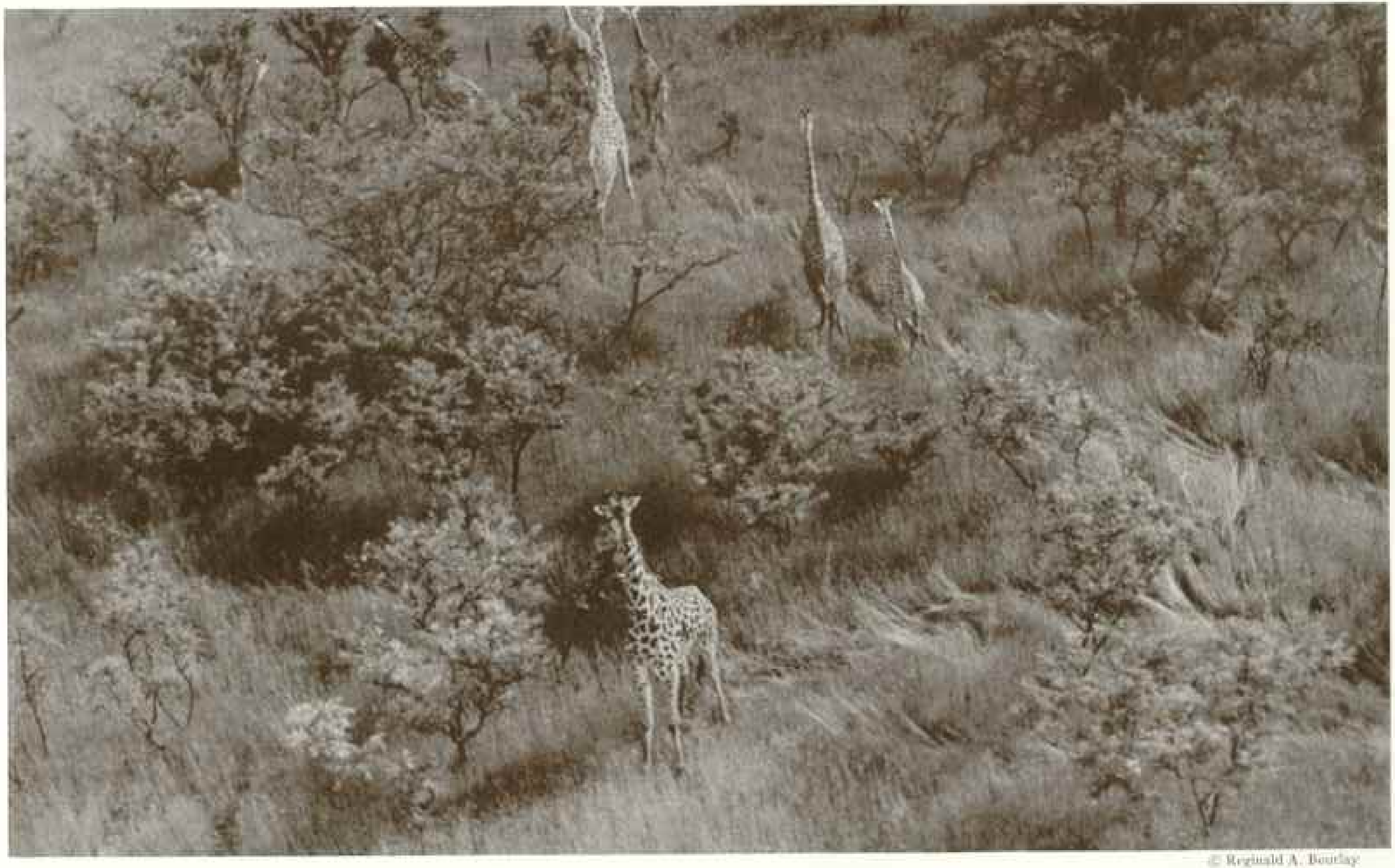
Photographs © Reginald A. Bourlay

CAPABLE FIGHTERS, BUT PACIFISTS, THEY PREFER PELL-MELL RETREAT

When cornered, sable antelopes battle furiously with their sweeping, thickly ringed, scimitar-shaped horns, grown by both male and female. Mr. Bourlay, a pilot for the Rhodesian and Nyasaland Airways, Ltd., made this series of remarkable aerial photographs while on regular trips to various parts of southern Africa.

FROM THE BASE OF LOFTY, SNOW-CAPPED KILIMANJARO, BIG GAME TRAILS RADIATE THROUGH TANGANYIKA UPLANDS

On safari to this 19,300-foot eminence, travelers encounter elands, gazelles, a few lions, zebus, lesser kudus, and other African wild life. Usually the towering giant is wrapped in clouds. The photographer pushed his plane to an altitude of 14,000 feet, at 6 o'clock in the morning, to make this picture.

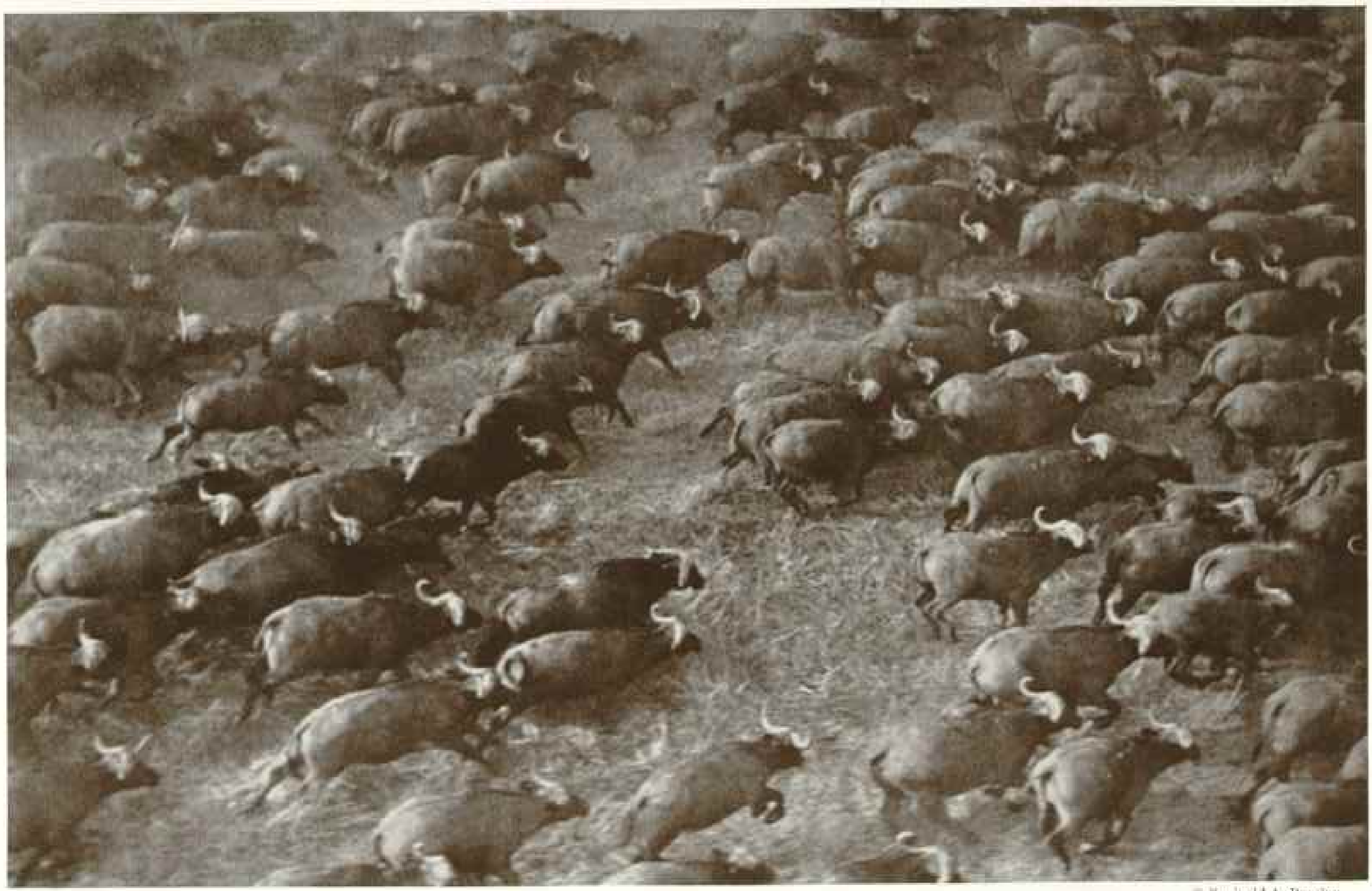


AIR-MINDED GIRAFFES ON THE BUHORO FLATS MOVE LEISURELY FROM THE PATH OF AN ONCOMING PLANE

Curiosity stays the retreat of the animal in foreground. The long-necked denizens of this wild section of Tanganyika are accustomed to the drone of motors in the skies, for they dwell on the route of the Imperial Airways. Here the photographer saw more giraffes than in any other part of Tanganyika or Kenya (542).

WHITE-BELLIED STORKS FILL THE AIR OVER A TEMPORARY STOPPING PLACE, AS THEY COMMENCE THEIR SOUTHERN MIGRATION

Exodus from Tanganyika begins when the rainy season sets in, about mid-November. The birds, also known as "rainbirds," "farmers' friends," or Abdim's storks, travel in flocks of about 400.

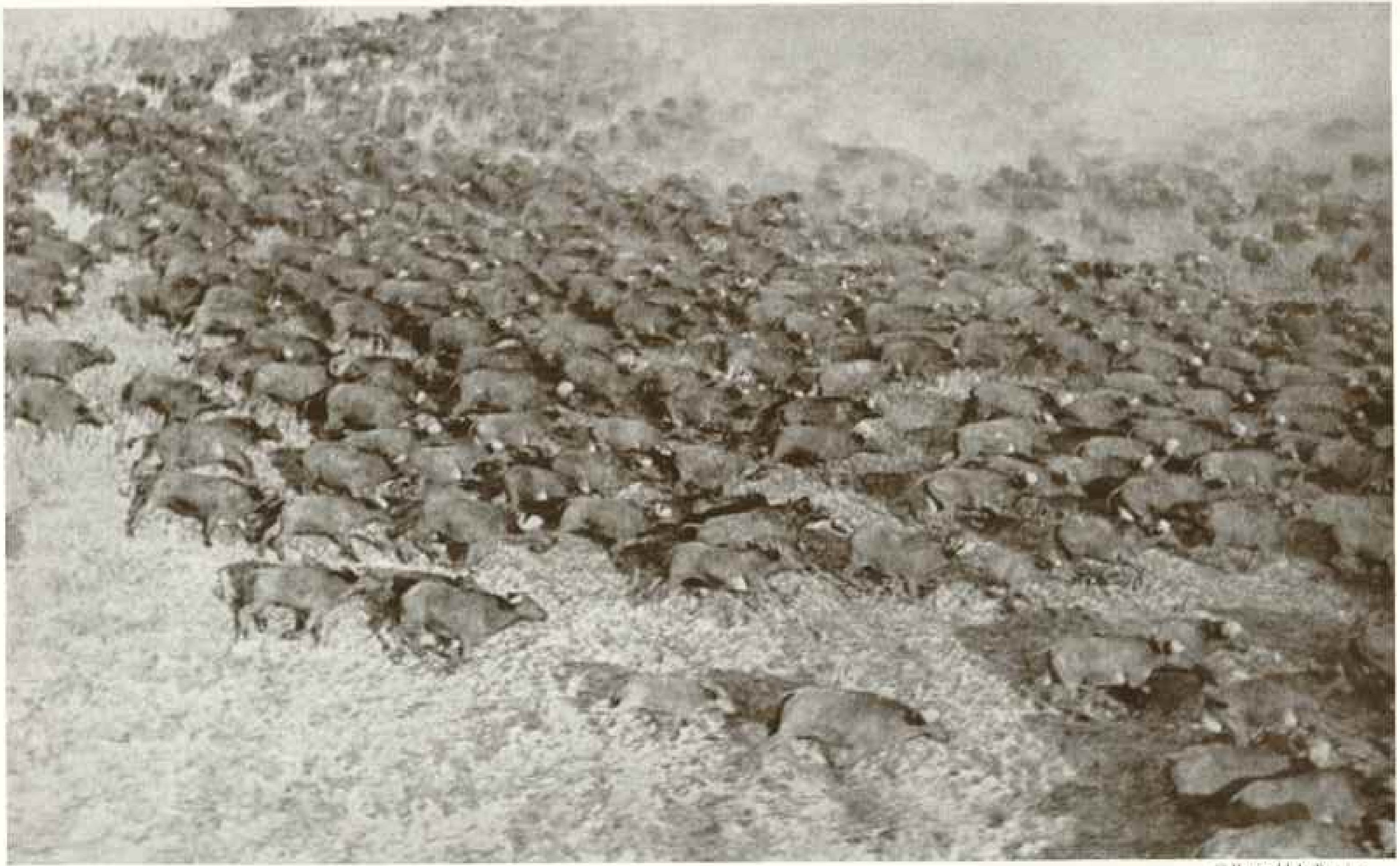


PUGNACIOUS AFRICAN BUFFALOES STAMPEDE AT THE SIGHT OF THE NOISY "BIRD" DROPPING FROM THE CLOUDS

Flying hoofs thunder over the dusty Gorongosa Plains of Mozambique as the animals dash for safety. Some 700 make up the herd (page 533).

DISTURBED IN THEIR MARSHLAND HAUNTS, NOISY LECHWI SPLASH AND BOUND ACROSS A SHALLOW STREAM

Soaring over the Kafue flats of Northern Rhodesia, the aviator-photographer came upon this herd of antelopes which are closely related to the waterbucks. When alarmed, they sound forth in a perfect chorus of loud grunts before taking to flight. Their spread hoofs come down with resounding smacks in the mud and they leave large tracks. "I consider this to be one of my best photographs," Mr. Bourlay writes.



ONLY ABOARD A PLANE IS MAN SAFE IN THE PRESENCE OF A STAMPEDING HERD OF AFRICAN BUFFALOES

Although this large band roams the Gorongosa Plains of Mozambique at will (page 531), the beasts are much less numerous throughout East Africa than they were before 1890, when they occurred in countless thousands. During that year they were afflicted with the rinderpest, or cattle plague, and were greatly depleted. African buffaloes are among the most dangerous big game animals, particularly when wounded. Both male and female have horns, the former with large bosses at the base.

LIONS, SURPRISED IN OPEN DAYLIGHT, HUSTLE FOR COVER

The beasts seldom are seen from the air on the Cheringoma Plains of Portuguese East Africa. They usually lurk in thickets and other places of concealment.

Photographs © Reginald A. Boucley

A RULER OF THE JUNGLE BEATS A SOLITARY RETREAT

It's every beast for itself when the plane roars down on the tribe. Usually these Musongwe lions move about in groups numbering up to eight.

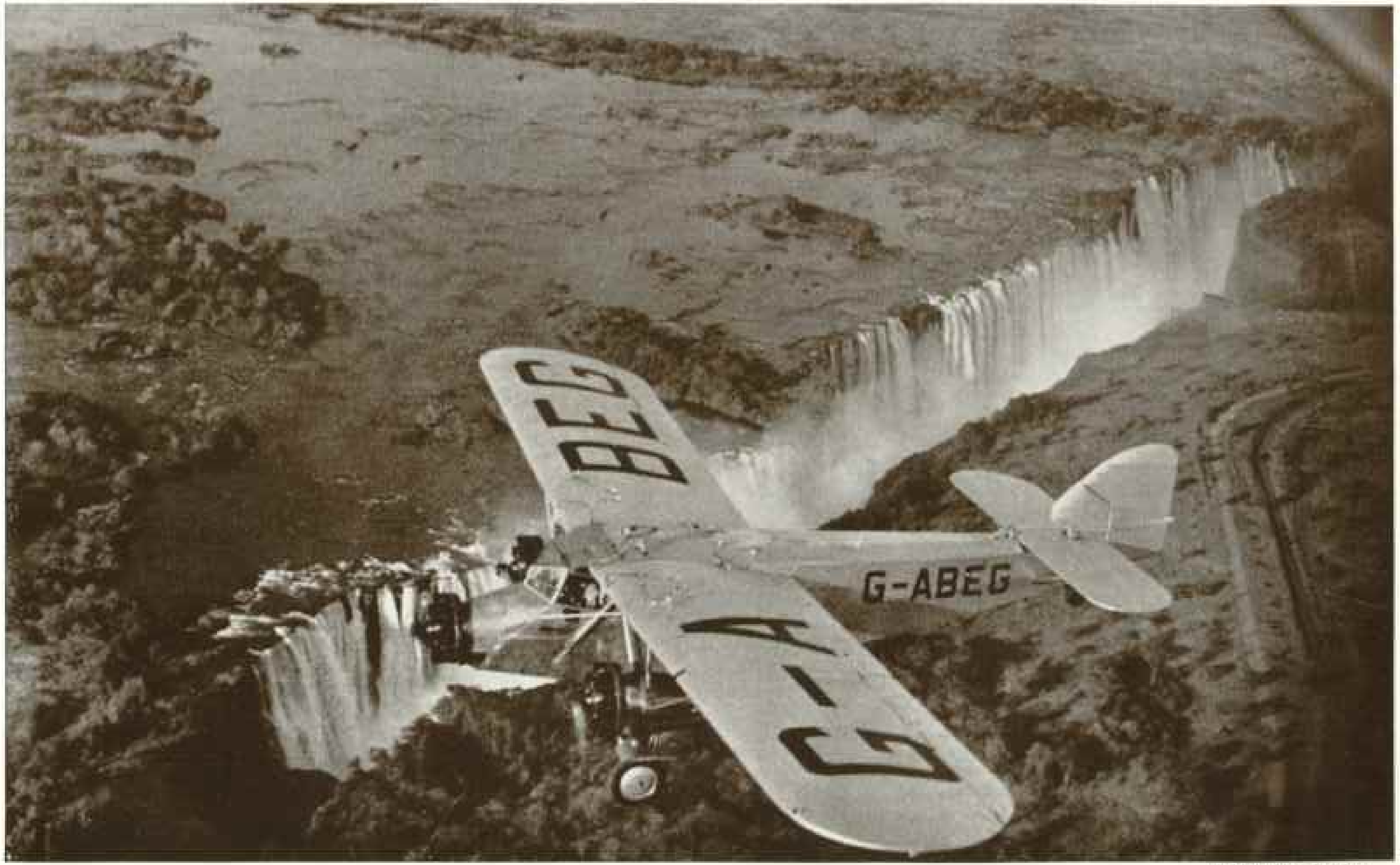
JUMBO, LEADER OF THE HERD, STANDS HIS GROUND AS THE PLANE NEARS

In fighting posture, he extends his broad ears to catch every sound. On a flight to the tin mines of Manono, Belgian Congo, Mr. Bourlay encountered the elephants in swamps south of the Kibara Mountains.

Photographs © Reginald A. Bourlay

FEARLESS AND DEFIANT, THE OLD BULL CHARGES THE WINGED INTRUDER

Dashing ahead of his fellows, the elephant lunged toward the plane just as the photographer snapped the picture. Hastily the downward flight was checked and the plane roared over Jumbo's head.



© Reginald A. Bourlay

WONDERS OF VICTORIA FALLS ARE REVEALED WEEKLY TO PASSENGERS ON THE REGULAR BULAWAYO-LIVINGSTONE AIR ROUTE

Waters of the Zambezi River, flowing over an even sheet of basalt, plunge abruptly over the edge of an almost vertical chasm. Here the river is more than 1800 yards wide. From 62 to 100 million gallons of water pour over the edge every minute. Only when the Zambezi is very low is it possible to look into the depths of the chasm 420 feet deep at its center, because of the clouds of spray. David Livingstone discovered the spectacular falls in 1855.

GIANTS OF THE JUNGLE TIRELESSLY COVER MANY MILES A DAY WITH THEIR SHUFFLING, GLIDING GAIT

Although they are moving swiftly over the Gorongosa Plains, they never run or gallop. Since elephants cannot jump and their stride is only about six and a half feet, a ditch seven feet wide will halt their progress. Builders of barless zoos confine their pachyderms behind straight-walled moats about ten feet wide. Despite their huge size, the animals are stealthy stalkers. An entire herd can leave a forest and disappear without breaking a twig or making a sound.

© Reginald A. Bourlay

STROLLING LEISURELY ACROSS THE GORONGOSA PLAINS, THESE CONTENTED ELEPHANTS NEED FEAR ONLY MAN

Colossal bulk of the pachyderms safeguards them from attack of all other animals except outlaws from the herd. No enmity exists between Jumbo and other jungle monarchs such as hippopotamuses, rhinoceroses, lions, or buffaloes. Baby elephants are energetically protected by their elders.

© Reginald A. Bourlay

BILLIARD BALL MAKER'S DREAM—A TON OF IVORY IN THE RAW ON THE GORONGOSA PLAINS

Tusks of African bull elephants average about 40 pounds apiece. Those weighing 100 pounds are not rare. One has been recorded which weighed 235 pounds and had a circumference of 26 inches. Old bulls with big tusks find it difficult to keep up with the herd. Sometimes they lodge the big teeth in forks of trees to give their weary neck muscles a rest.

NATURE'S CAMOUFLAGED HORSES COULD REDOUBLE THEIR SPEED IF A LION WERE AT THEIR HEELS

The airplane does not inspire as much terror as the king of the jungle, which preys upon zebras. Leo must stalk his quarry carefully, for the fleet runners can outstrip him on open stretches, such as this section of the Ruhoro Flats in Tanganyika. Against other animals zebras are brave, attacking savagely with their hoofs. Because of their stripes, the animals are barely discernible against a background of scrub growth.

UNWIELDY HIPPOPOTAMUSES, MILD AND INOFFENSIVE, MILL ABOUT IN THE COOLING WATERS OF THE SUNGUE RIVER

Roar of the airplane motor only slightly disturbs this East African herd in quiet search for underwater plants, a favorite diet. When wounded, or defending their young, the bulky beasts are remarkably agile and immensely strong. Sometimes the old bulls, like elephants, become "rogues" and attack anything and everything within sight. Hides of the huge animals are two inches thick in places and are virtually hairless.

RUBBERNECK COMES TO ATTENTION AS THE PLANE'S SHADOW NEARS HIS PATH

Leaves of trees on the Buhoro Flats of Tanganyika (page 529) interested this giraffe until it heard the plane. Instead of fleeing, it merely stretched its long neck upward as far as possible for a good look.

Photograph © Reginald A. Bourlay

OVER THE ATHI PLAINS OF KENYA A GIRAFFE RACES AT FULL SPEED

These tallest mammals can run thirty miles an hour. They sometimes grow to a height of 18 feet 7 inches. Once giraffes were found in large herds, but hunters have caused their extermination in many districts.

belched flames and bits of molten lava.

All these attributes—lava lake, stream, and cones—were scattered in various places, at distances of several hundred yards; and there seemed to be no visible connection between them. It is not certain that the lava in the lake had anything to do with the existence of a lava stream and gas vents half a mile away.

LAVA FROM A CRATERLESS VOLCANO

For weeks and for months the lava has been flowing down into the stream. It spreads out in the plains at the foot of the mountain and covers several hundred square miles, advancing relentlessly south, west, and north, on a very large front. Nothing is left of the magnificent forest. Herds of elephants have fled, and everywhere the sight is one of utter destruction.

The stream of fire has now reached the northwestern corner of Lake Kivu, into which it is flowing amid gushing columns of steam. Fish, somewhat surprised at the intrusion, are given little opportunity to think the matter over, to the great joy of the natives who follow the process with eager expectation of boiled fish for supper.

GROUND HOLES BELCH FLAME

At the volcano itself the sight was most unusual. Holes in the ground were belching huge flames, several yards high. Sheaves of incandescent material were blown high into the air from the cones and then fell back on the ground flat as pancakes.

The lava lake was like a lake of fire. Bubbles of gas were gushing through the molten, bright-orange rock, which sprang up as fountains of liquid fire. Heavy blue clouds of smoke with a pungent smell of sulphur would stick to the ground, drowning the landscape in a deadly haze.

When I reached the volcano about a month after the beginning of this phenomenon, I established my camp a few hundred yards above Shambene, in a forest of giant heather. From this vantage point I commanded a wonderful view of the volcanic display.

SETTLING DOWN TO COMFORTS OF HOME—ON A VOLCANO

I remained there permanently from February to October, devoting my time to the study of this extraordinary spectacle. Fortunately, Shambene could be approached quite easily, if care were taken to remain out of the wind; and it offered unusually good opportunities for a close study.

On the whole, life on the volcano was quite comfortable, except for the rains and lasting fog. The native porters built themselves huts with which they seemed well satisfied. They would be content with almost any type of construction provided it kept out rain and kept in the smoke.

They spent their time running up and down the mountain, carrying supplies, fresh milk, and vegetables, all of which they brought up daily from a distance of about twenty miles. Strangely, the eruption seemed to make no great impression on them, and they paid practically no heed to the lava, which, to them, is just "fire."

The people on the northern slopes of the volcano, from whom the porters were recruited, appear to be as a whole a rather unimaginative lot; and I could not find out whether they had any tales or legends relating to the volcanoes. It seems probable that they have none.

The country immediately around Nyamlagira is practically uninhabited because of lack of water; consequently, the natives suffered very little from the eruption and, as a result, had little or no interest in it (page 521).

To me outdoor life over long periods of time is far more comfortable in wild Africa than in the so-called "civilized" countries.

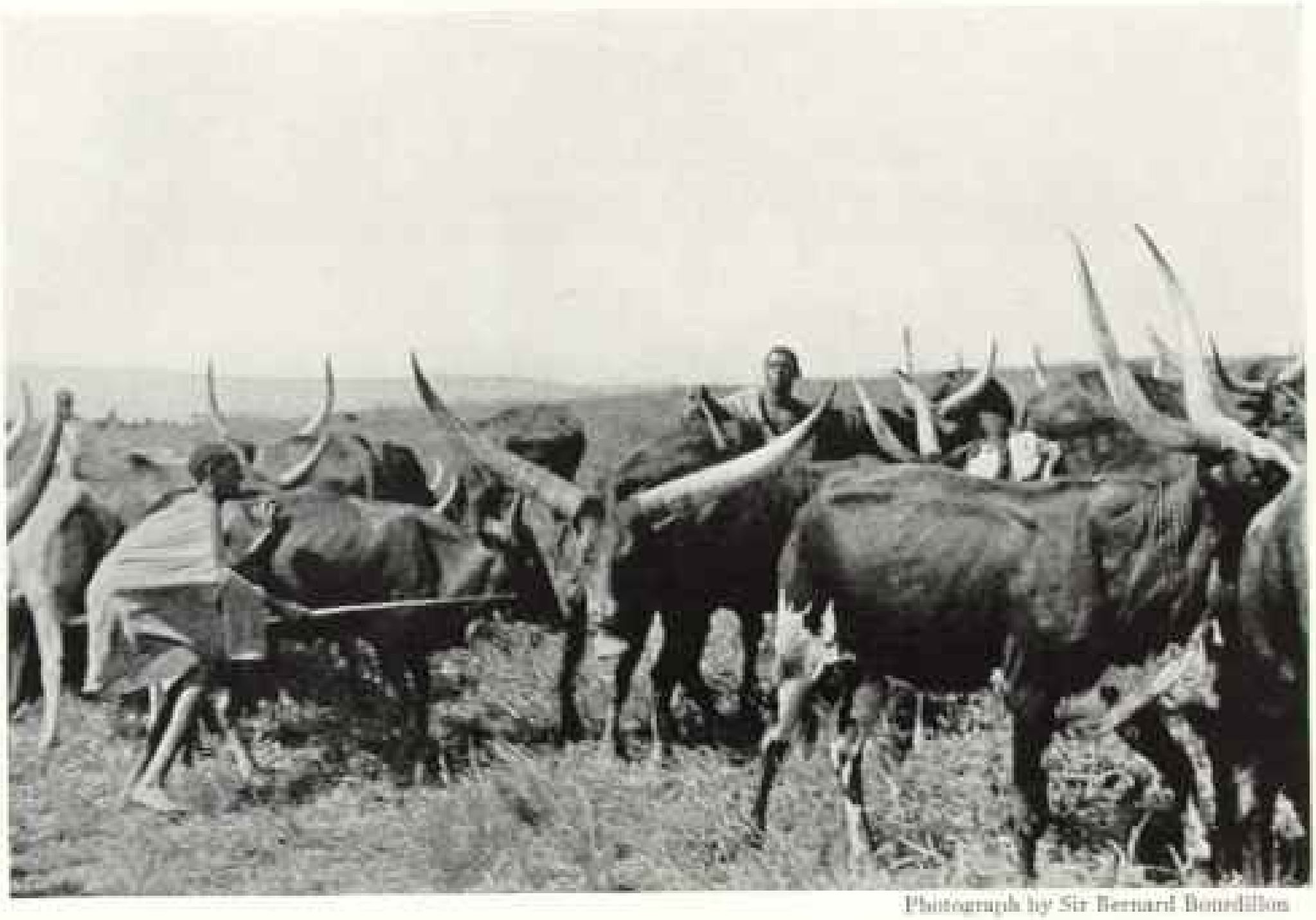
THEY GOT ALONG WITH 3 PORTERS AND 3 WORDS VERY WELL

But when one realizes how truly comfortable and luxurious it feels to go around with never less than three porters—one for the camera, one for the tripod, and the third as a spare—a fresh outlook is gained. Then this part of Africa seems no longer such a backward place, and the advantages of civilization become less obvious.

I never quite understood how my porters and I got along as well as we did considering the fact that we probably didn't understand more than three words of one another's language. True, much can be expressed in three words, provided they mean "go fetch food."

Each tribe or social class of natives has a language of its own, which is usually difficult grammatically, each word having infinite shades of meaning.

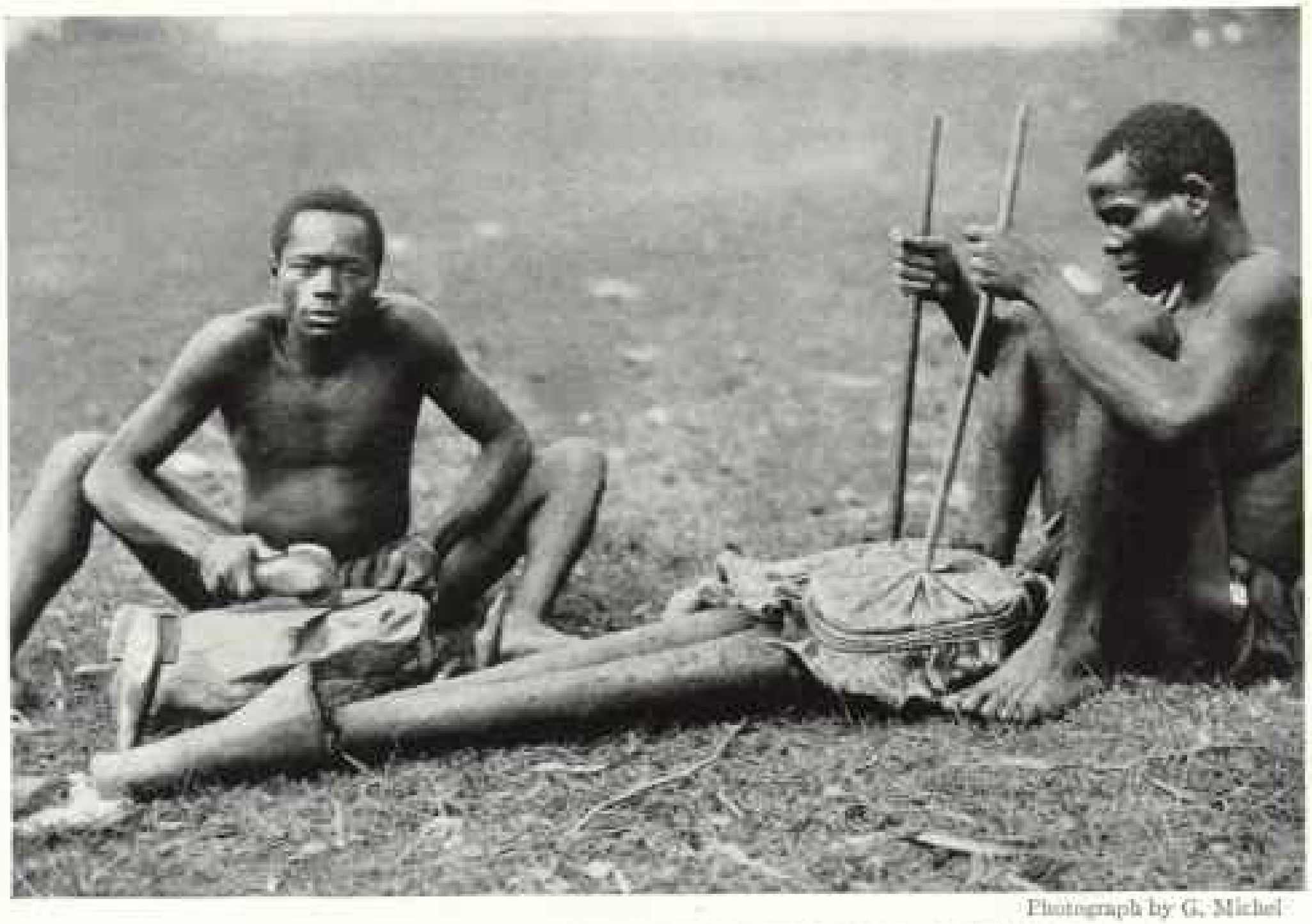
Fortunately, a sort of international language, derived from the Swahili of the



Photograph by Sir Bernard Bourdillon

LONG-HORNED ANKOLE CATTLE ORIGINALLY CAME TO RUANDA WITH THE WATUSSI

When the conquerors entered the country they brought their herds with them. Thousands of the animals have been killed by rinderpest, or cattle plague, since 1896. Recently modern dipping methods have made progress in combating the disease.



Photograph by G. Michel

THE VILLAGE SMITH SITS BEFORE HIS ANVIL OF STONE

Bellows of animal skins and a hollowed double tree branch conduct the air to the forge. With a piece of iron for a hammer, the blacksmith makes knives and hoes.

ONLY WOMEN THUMP THE POTTER'S CLAY IN THE BELGIAN CONGO

To make a new jug, she uses an old one for a model and shapes the prepared clay over it. Then she sets the new one in the sun to dry and afterwards bakes it. The finished product is used to fetch water from a near-by stream.

Photographs by G. Michel

BABY ON BACK, MOTHER COMES TO MARKET TO BUY A LITTLE SALT

The stall is in the market place of Sake, flourishing hamlet at the northwestern corner of Lake Kivu, in the Belgian Congo (page 525). Lava from erupting Nyamlagira flows into the lake.

© Captain C. R. S. Pitman

ON NYAMLAGIRA'S SLOPES STRETCHES A SCENE OF BLACKENED DESOLATION

As far as the eye can see there is lava, lava, lava. The cooling, solidified substances, in weird shapes and formations, have swallowed up the countryside. Some segments are high up in the dead trees.

Photograph by Jean Verhoogen

AS SOON AS THE LAVA COOLS, HARDY GROUNDSEL TAKES ROOT

The stretch of solidified lava in which the plant is bravely blooming was a molten mass only three months before the author made this photograph. This shrub may grow to 15 feet (page 525).

FUMES SHOOT FROM A WIDE, ABYSMAL SULPHUR VENT

Bright-yellow deposits and crystals line the terrifying pit on Nyamlagira. The gaping aperture has no visible ending.

Photographs © Captain C. R. S. Pitman

A SEETHING NEW CRATER BURSTS FORTH ON NYAMLAGIRA

Except for the small, dark island in the center, this focal point of eruption is a flame-red lake of glowing molten lava—a boiling mass!

Photograph by Dr. Franz Stoedtner

WATUSSI BOYS DANCE THE "BOW AND ARROW COMBAT"

Sons of the tall aristocrats of Ruanda, Belgian Congo, keep alive the traditions of the original conquerors of the country. Many of the men are more than seven feet tall. They excel at high jumping, often clearing the bar at a height of seven and a half feet.

Photograph by G. Michel

RHYTHMIC POUND OF THE PESTLE LULLS BABY TO SLEEP

A band stretched from the mother's forehead supports the little fellow upon her back while she grinds meal for the family dinner.

Photograph by Vittorio Sella

A GIANT LOBELIA STANDS SENTINEL ON THE MOUNTAIN SLOPE

This plant, with its tall spikes, is related to the smaller annual or perennial herbs of the same name. It thrives at high elevations (page 525).

eastern coast, has spread over all of eastern and central Africa and is very much used between natives and natives, between natives and Europeans, and sometimes also between Europeans of different countries. By this extensive use the language has become very much simplified, and one can make oneself understood with relatively little effort.

ERUPTION SHOWED NO SIGNS OF WANING AFTER 8 MONTHS

About eight months were spent on the volcano, and still the eruption showed no signs of waning. The lava was running as fast and as abundantly as on the first days. Ample opportunity was given for a close study of the phenomenon, and much data could be secured on the temperature of the lava, the burning gases, etc.

The problem of the mechanics of volcanoes is one of the most fundamental problems of geology. Unfortunately, the work at Nyamlagira was interrupted, partly for lack of money and time.

Nyamlagira is certainly an outstanding volcano and one of the most favorable places on earth for detailed studies of volcanic activity. It is our hope that scientific research will be continued and a permanent observatory established there in the near future.

TIMELY ARTICLES AND MAPS GIVE GEOGRAPHIC MEMBERS BACKGROUND OF EUROPEAN DRAMA

MEMBERS of the National Geographic Society are reminded that their Magazine, in the past 12 months, has presented a series of authoritative articles which give the background of areas involved in the present European situation, and also neutral countries which seek to keep out of the maelstrom.

Earlier featuring of European places, including dozens of articles and hundreds of natural-color and monochrome photographs, may be located by quick reference to the *Cumulative Index to the* NATIONAL GEOGRAPHIC MAGAZINE.

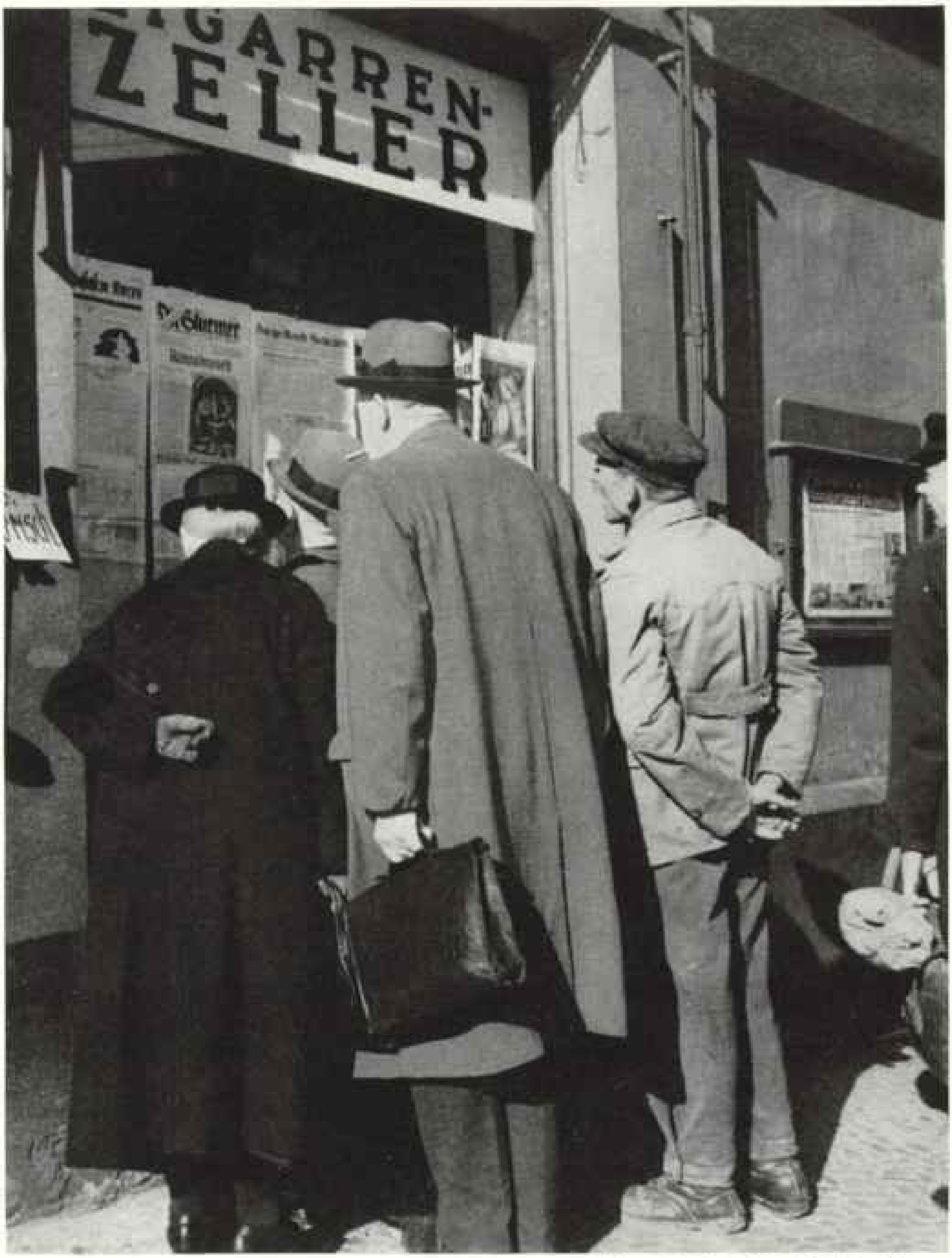
The pertinent articles of the past year include the following:

"The Farthest-North Republic" (Finland), by Alma Luise Olson, October, 1938.
"An American Girl Cycles Across Romania," by Dorothy Hosmer, November, 1938.
"The Transformation of Turkey," by Douglas Chandler, January, 1939.
"Time and Tide on the Thames," by Frederick Simpich, February, 1939.
"The Smallest State in the World" (Vatican City), by W. Coleman Nevils, March, 1939.
"Country Life in Norway," by Axel H. Oxholm, April, 1939.
"Pedaling Through Poland," by Dorothy Hosmer, June, 1939.
"Land of Europe's Youngest King" (Yugoslavia), by Douglas Chandler, June, 1939.
"Looking Down on Europe Again," by J. Parker Van Zandt, June, 1939.
"Life's Flavor on a Swedish Farm," by Willis Lindquist, September, 1939.

The maritime aspect of the international situation may be followed with the aid of the Map Supplement of the Atlantic Ocean sent to members with their July, 1939, issue, which also contained the article on "The World That Rims the Narrowing Atlantic," by James M. Darley.

With the Atlantic Map, and the timely Map of Central Europe and the Mediterranean in this issue, members will be able to locate datelines and follow every phase of political and military activity.

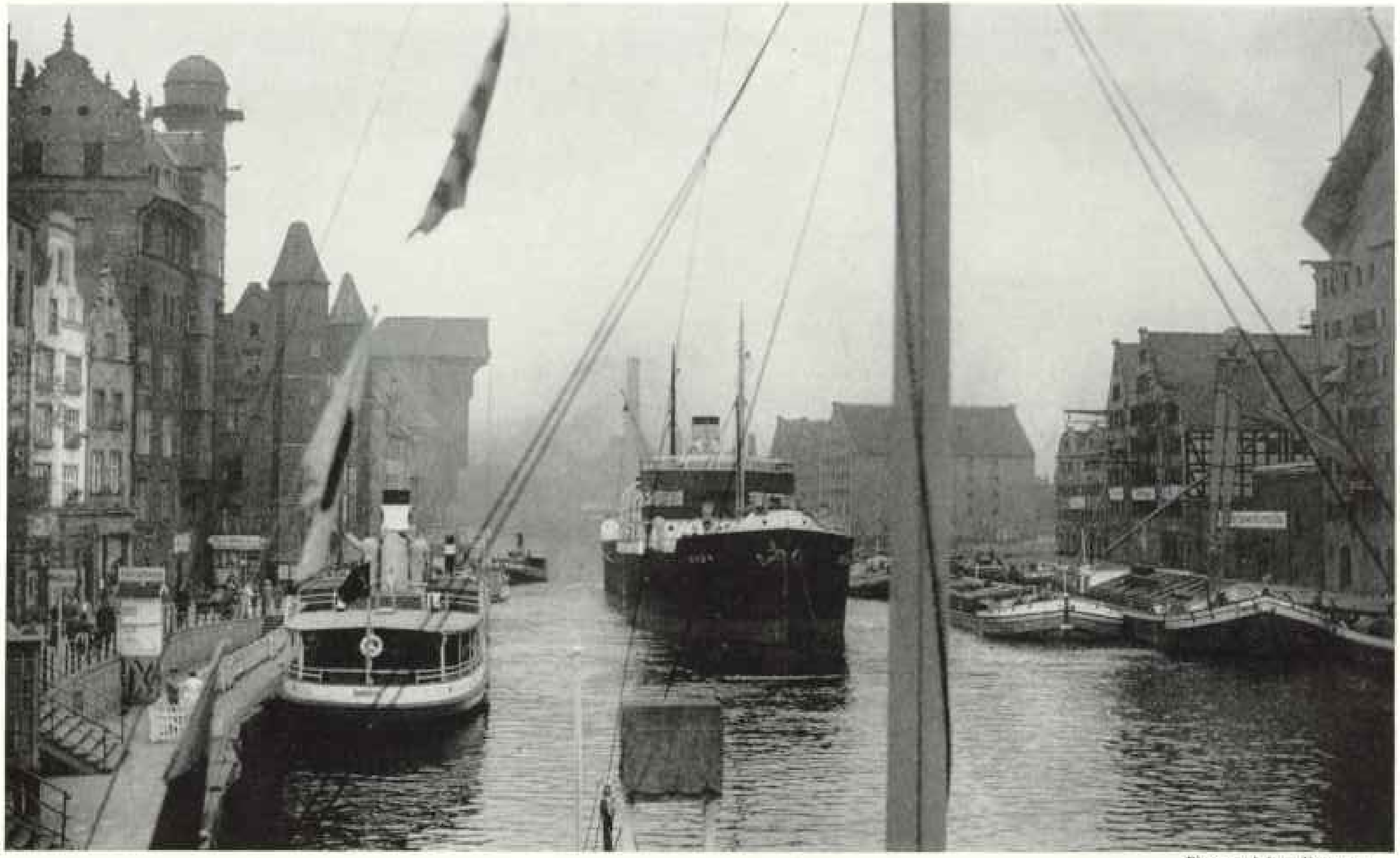
War Clouds Over Danzig and Poland's Port



Photograph by Rene Zuber, © C. Anders & Co.

AUGUST, 1939, HEADLINES! PEACE OR WAR?

German citizens of Danzig anxiously scan the daily newspapers in the window of a freshly painted tobacconist's shop. The venerable city on the left bank of the Vistula, four miles from the Baltic Sea, was the capital of West Prussia at the close of the World War. By the terms of the Treaty of Versailles, in 1919, the city and surrounding territory became a Free State, administered by the League of Nations, but in customs union with Poland. Adolf Hitler's demand that Danzig be returned to Germany, and Poland's refusal to agree to such a transfer, precipitated the world crisis of August, 1939.



Photograph from European

OCEAN-GOING VESSELS "TAXI" UP THE MOTTLAU PAST THE RIVERSIDE FRONT DOORS OF DANZIG

Two navigable branches of the stream split Danzig into three sections before they join the waters of the Vistula. The dome-topped building at the left is the old observatory and beyond it, extending over the water, stands the famous Crane Tower (page 555). The Vistula River connects Danzig with Poland and, by means of tributaries and canals, with Germany, the Ukraine, and Lithuania. Express trains speed to principal cities of Germany, Poland, and the Baltic States.

Photograph from *Europress*

FROM BERTHS ON THE MOTTLAU RIVER, DANZIG'S OWN SHIPS LEAVE FOR FARAWAY PORTS

Regular passenger and cargo sailings are listed to major harbors on the Baltic and North Seas, to London and Hull in England, even to New York and Philadelphia, and to Canadian cities.

Photograph by Ilene Zuber, © C. Anders & Co.

COBBLESTONE ROADS LEAD INTO DANZIG FROM THE POLISH TOWN OF TCZEW

Here the border line runs north and south, with Polish territory to the west. The Free State, a little more than two-thirds the size of Rhode Island, with a population of 407,000, has land boundaries extending 147 miles. In addition to Danzig proper, and Zoppot, it embraces 254 villages and hamlets.

© Harms Tschira from European.

DANZIG STILL STORES CARGOES IN HER FIVE-CENTURY-OLD CRANE TOWER

Cumbersome machinery in the massive structure on the Motlau River hoists foodstuffs and merchandise from the holds of ships tied up alongside. Two big treadwheels furnish motive power. The storehouse was built nearly half a century before Columbus sailed. Then Danzig was Poland's granary.

© Foto-Smoke from Black Star

HALT! DANZIG BORDER GUARDS INSPECT AN AUTOMOBILE AT THE POLISH BOUNDARY

At Steinfliess, just outside Zoppot, on the road to Polish Gdynia, a woman traveler presents passport and permits. One guard is raising the barrier, which will permit the car with the Danzig license to cross to Polish soil.

Photograph from Ewing Galloway

MODERN GDYNIA, POLAND'S NEW WINDOW ON THE BALTIC, LIES AT THE TIP OF THE POLISH CORRIDOR

Only fishermen's rude huts occupied this site at the close of the World War. In the last 20 years a modern harbor with vast docks, warehouses, and giant coaling cranes has mushroomed into being. Poland built her own sprawling seaport here to lessen dependence on Danzig, twelve miles away. By 1937 Gdynia's imports of nearly a million and a half tons were double those of Danzig (page 358).

Photograph by Rene Zuber, © C. Anders & Co.

SOLARIUM APARTMENTS RISE IN MODERN GDYNIA, POLAND'S MADE-TO-ORDER SEAPORT

A drugstore occupies the first-floor corner. The city has been one of the fastest growing communities in the world, with a population jumping from only a thousand in 1919 to nearly 120,000 today (page 557).

THE SOCIETY'S NEW MAP OF CENTRAL EUROPE AND THE MEDITERRANEAN

EVER-CHANGING Europe—source of New World peoples and parliaments, printing and poetry, and much of our praying and planting—is delineated again in a timely map supplement distributed to members of the National Geographic Society with this issue of their Magazine.*

Because of the time necessary for printing more than a million copies of the map, the press run started on August 28. Should there be any changes of boundaries or names, these alterations will be made during the press run.

Such a change was made during the printing of the Map of Europe sent to members with their Magazine in April, 1938, when sovereignty over Austria was transferred to Germany.

Whenever a European boundary is shifted, a people freed or encompassed by a new sovereignty, or a familiar place name altered, that is homeland news for Americans, whether newly arrived or conscious of oft-told tales handed down through ancestral generations.

The course of European settlement can be traced across North and South America in the homes of the inhabitants, in the words they speak, the books they read, the food they eat, the churches where they worship, the songs they sing.

The Mediterranean, with all its 14,000-mile shoreline shown, was the cradle of navigation, sea-borne commerce, and international trade. From its peninsulas and islands came our laws, genius for organization, much of our architecture, the impulse for exploration which found the rich lands we live in.

NAMES RICH IN LORE AND SENTIMENT

Therefore the new Map of Central Europe and the Mediterranean, 36½ by 26½ inches, with its 6,212 place names, not only is an accurate chart for wall framing or desk reference, but a rich volume for the association of events with places indelibly engraved by history and etched into our daily lives.

Waterloo, Versailles, and Austerlitz: Parisian, Viennese, Mediterranean—all have deep overtones of meaning that have spread far beyond their map locations.

Mention the Niemen River and Tilsit, and a schoolboy will recall where Napoleon and Alexander I met on a raft to divide the world between them. Rouen and Domrémy were immortalized by Joan of Arc, and Cannæ by Hannibal's virtual annihilation of a Roman Army of 70,000 men. From there he sent back to Carthage a bushel of gold rings snatched from the fingers of Roman knights.

At Lake Trasimene Hannibal ambushed his entire army, and destroyed most of the troops opposed to him. At Chalons-sur-Marne, Attila, the "scourge of God," was defeated by the allied Romano-Goths; Venice was founded on lagoon islands by refugees fleeing before the Huns.

Ramsgate was landing place of St. Augustine of Canterbury, who converted the English to Christianity, and another religious marker is Worms on the Rhine, famous for the Diet of 1521—and so the list might continue almost interminably.

CHEESES, CATTLE, AND CHEMICALS

Many places on the map have given names to articles in everyday use, and we are so familiar with these terms that we think seldom of their origin.

We walk on Brussels carpet, order Brussels sprouts from the grocer, and admire Brussels lace. A list of famous laces reads like a gazetteer: Alençon, Valenciennes, Chantilly, Venice, Mechlin, Antwerp, Binche, Cluny, Milan, Honiton, Lille, Arras, and Genoa.

It is the same with names of wines: Bordeaux, Burgundy, Malaga, Champagne, Sauterne, Rhine, Moselle. And then there are such modifications as Port, after Pôrto, in Portugal; Sherry, for Jerez, in Spain, and Tokay, for Tokaj, in Hungary.

A list of the Channel Islands suggests a program for a livestock show, what with Guernsey, Jersey, and Alderney.

Connoisseurs of cheeses can find most of their favorites roving the map: Cheddar and Cheshire; Stilton, Gouda, Edam; Gorgonzola, Roquefort, Camembert, Neufchâtel. Slightly changed are Parmesan, from Parma, in Italy; Gruyère from Gruyères, Switzerland, and Limburger from Limbourg Province, Belgium.

* Members wishing additional copies of the map, "Central Europe and the Mediterranean," may obtain them by writing the National Geographic Society, Washington, D. C. Prices, in United States and Possessions, 50¢ on paper (unfolded); 75¢ mounted on linen; INDEX, 25¢. Outside of U. S. and Possessions, 75¢ on paper; $1 on linen; index, 50¢. Postage prepaid.

Even the chemist can trace the labels on his shelves to labels on the map.

The element lutecium takes its name from Lutetia, as ancient Paris was known. It belongs to the ytterbium group of earths, named from a town, Ytterby, in Sweden. Three other chemical elements are named for this same town: erbium, terbium, and yttrium.

Indeed, the chemical list rivals that of the cheeses: europium; gallium for Gallia, Latin for France; magnesium for Magnesia, a district in ancient Greece; masurium for Masuria, in East Prussia; rhenium for the Rhine Province; ruthenium for Ruthenia; thulium for Thule (Northland), germanium for Germany, and scandium for Scandinavia.

Every major chapter in European history—the Norman Conquest, the Magna Carta, the Reformation, the Renaissance, the Industrial Revolution, the World War—all have touched America, as does the news of today.

NEW MAP IS NEWS SUMMARY

The new Europe map summarizes portentous developments of recent months.

Before the World War Europe had 11,000 miles of national boundary lines; after the peace treaties these were stretched to 17,000. Now they have shrunk again to 15,500.

Czechoslovakia, born in 1918, is missing from the 1939 map. It has gone to join Montenegro and other ghost countries of the past, its four provinces administered now by three governments. Two of these provinces, Bohemia and Moravia, are a protectorate of the German Reich; Slovakia is an independent state; and Ruthenia, renamed Carpatho-Ukraine, has been incorporated into the territory of Hungary.

These boundary changes entail changes in place names. In Bohemia and Moravia the old German names are again in vogue. Plzeň once more is Pilsen, and České Budějovice reverts to Budweis; while Slavkov again becomes Austerlitz, as it was known when Napoleon won his greatest victory there.

In Slovakia, because of its autonomy, place names remain the same, but in the Carpatho-Ukraine they become Hungarian. Chust, for instance, is replaced by Huszt.

In March, 1939, Lithuania restored the territory of Memel to Germany and that 1,100-square-mile area is shown on the new map with its new political coloring.

Albania, now wearing the map yellow of Italy, reflects its new political status in the renaming of Santi Quaranta, changed to Porto Edda, to honor the daughter of Premier Mussolini.

The ceding of the Hatay Republic by France to Turkey in June, 1939, increased the area of that country by nearly 2,000 square miles. This Republic, formerly part of the Levant States, was administered by France under a League of Nations mandate.

The change from French to Turkish administration also made necessary new place names. Antioch, scene of St. Paul's first ministry, is now Antakya, and Alexandretta becomes Iskenderon.

Many new place names appear in Libia as the result of Italian colonization. Marconi and D'Annunzio are among them.

That part of the U. S. S. R. shown on the map represents an entirely new selection of place names based on the new Soviet Atlas and recent official Soviet maps. In the much discussed Ukraine, in the neighborhood of Stalino, appear in large type such new and important names as Makeevka, Ordzhonikidze, Gorlovka, and Sergo.

Limiting the new map to Central Europe increases the scale to permit 1,207 names within the area charted which did not appear on the Europe Map published April, 1938. Also, 173 places here shown have had their names officially changed within the eighteen months since the Europe map of last April.

MAP INDEX A GAZETTEER OF CHANGING PLACE NAMES

The index to your new map is of especial reference value because it not only lists all place names, but also gives cross references for important features whose national or historic spellings are different from those familiar to English-speaking users. The erstwhile capital of Czechoslovakia, for example, is listed three times: under *Praha*, the Czech spelling; *Prag*, the German one; and also under the familiar English one, *Prague*.

The New Map of Central Europe and the Mediterranean, which also contains contiguous areas of Asia and Africa, is drawn on a scale of 78.91 miles to 1 inch. It is the third of four important map supplements planned this year. When the fourth, that of Central America and the West Indies, appears in December, the National Geographic Society will have distributed in 1939 more than 4½ million large 10-color maps to its membership.

NATIONAL GEOGRAPHIC SOCIETY

GEOGRAPHIC ADMINISTRATION BUILDINGS

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ORGANIZED FOR "THE INCREASE AND DIFFUSION OF GEOGRAPHIC KNOWLEDGE"

To carry out the purposes for which it was founded fifty-one years ago, the National Geographic Society publishes this Magazine monthly. All receipts are invested in The Magazine itself or expended directly to promote geographic knowledge.

Articles and photographs are desired. For material which The Magazine can use, generous remuneration is made.

In addition to the editorial and photographic surveys constantly being made, The Society has sponsored more than 100 scientific expeditions, some of which required years of field work to achieve their objectives.

The Society's notable expeditions have pushed back the historic horizons of the southwestern United States to a period nearly eight centuries before Columbus crossed the Atlantic. By dating the ruins of the vast communal dwellings in that region, The Society's researches have solved secrets that have puzzled historians for three hundred years.

In Mexico, The Society and the Smithsonian Institution, January 16, 1939, discovered the oldest work of man in the Americas for which we have a date. This slab of stone is engraved in Mayan characters with a date which means November 4, 291 B. C. It antedates by 200 years anything heretofore dated in America, and reveals a great center of early American culture, previously unknown.

On November 11, 1935, in a flight sponsored jointly by the National Geographic Society and the U. S. Army Air Corps, the world's largest balloon, *Explorer II*, ascended to the world altitude record of 72,395 feet. Capt. Albert W. Stevens and Capt. Orvil A. Anderson took aloft in the gondola nearly a ton of scientific instruments, and obtained results of extraordinary value.

The National Geographic Society-U. S. Navy Expedition camped on desert Canton Island in mid-Pacific and successfully photographed and observed the solar eclipse of 1937. The Society has taken part in many projects to increase knowledge of the sun.

The Society cooperated with Dr. William Beebe in deep-sea explorations off Bermuda, during which a world record depth of 3,028 feet was attained.

The Society granted $25,000, and in addition $75,000 was given by individual members, to the Government when the congressional appropriation for the purpose was insufficient, and the finest of the giant sequoia trees in the Giant Forest of Sequoia National Park of California were thereby saved for the American people.

The world's largest ice field and glacial system outside the Polar regions was discovered in Alaska by Bradford Washburn while making explorations for The Society and the Harvard Institute of Exploration, 1937-8.

How deep is the mud under the ocean?

FOR centuries, man has only *guessed* at the depth of the sand, gravel, and mud on the ocean floor. *Now he's getting the facts*—thanks to a new technique developed by Dr. Maurice Ewing of Lehigh University, who, during the past few months, has been sounding the depth of ocean-bottom sediment with the aid of deep-sea bombs and recording instruments, the delicate timing of which is entrusted to six Hamilton railroad watches.

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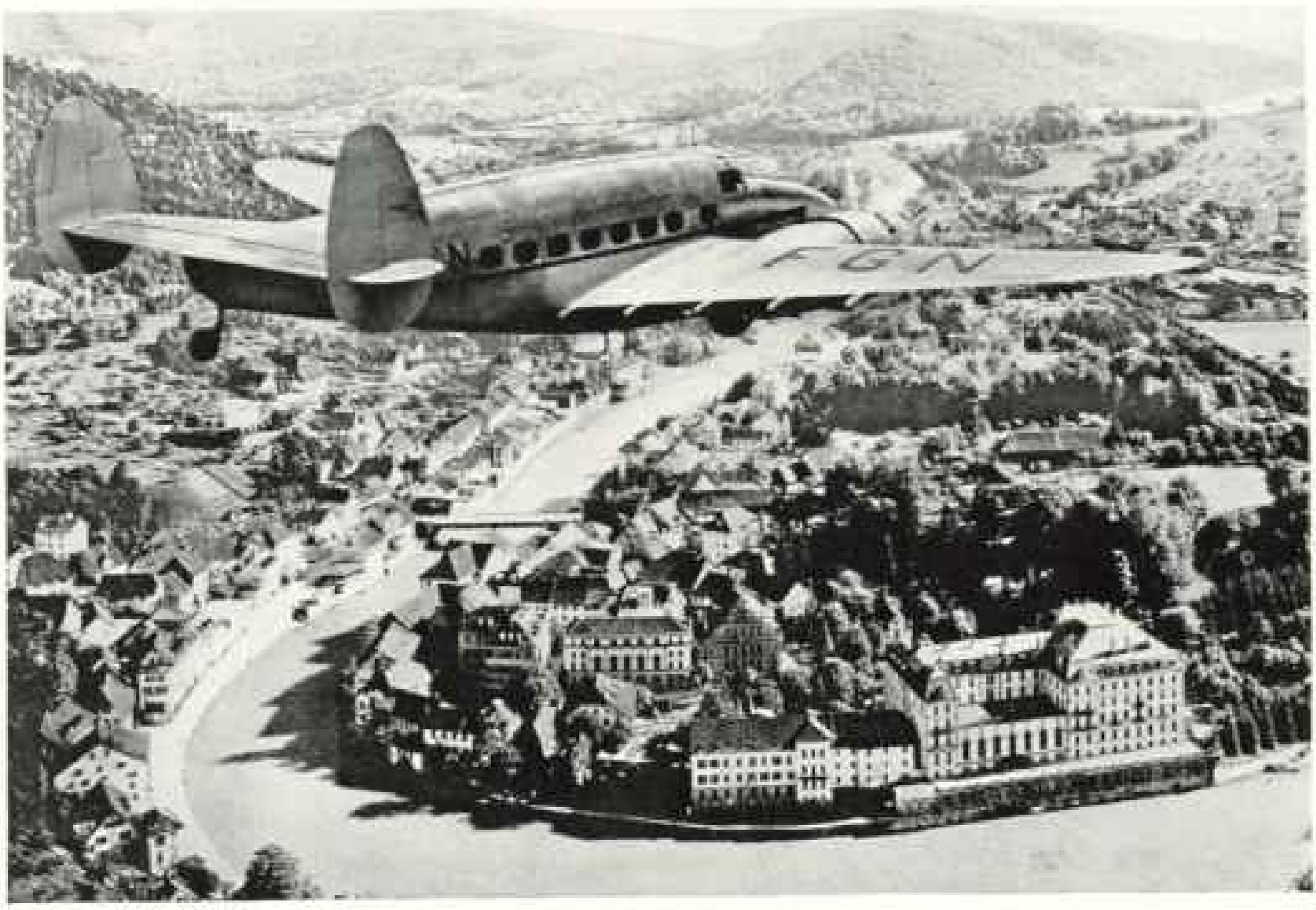

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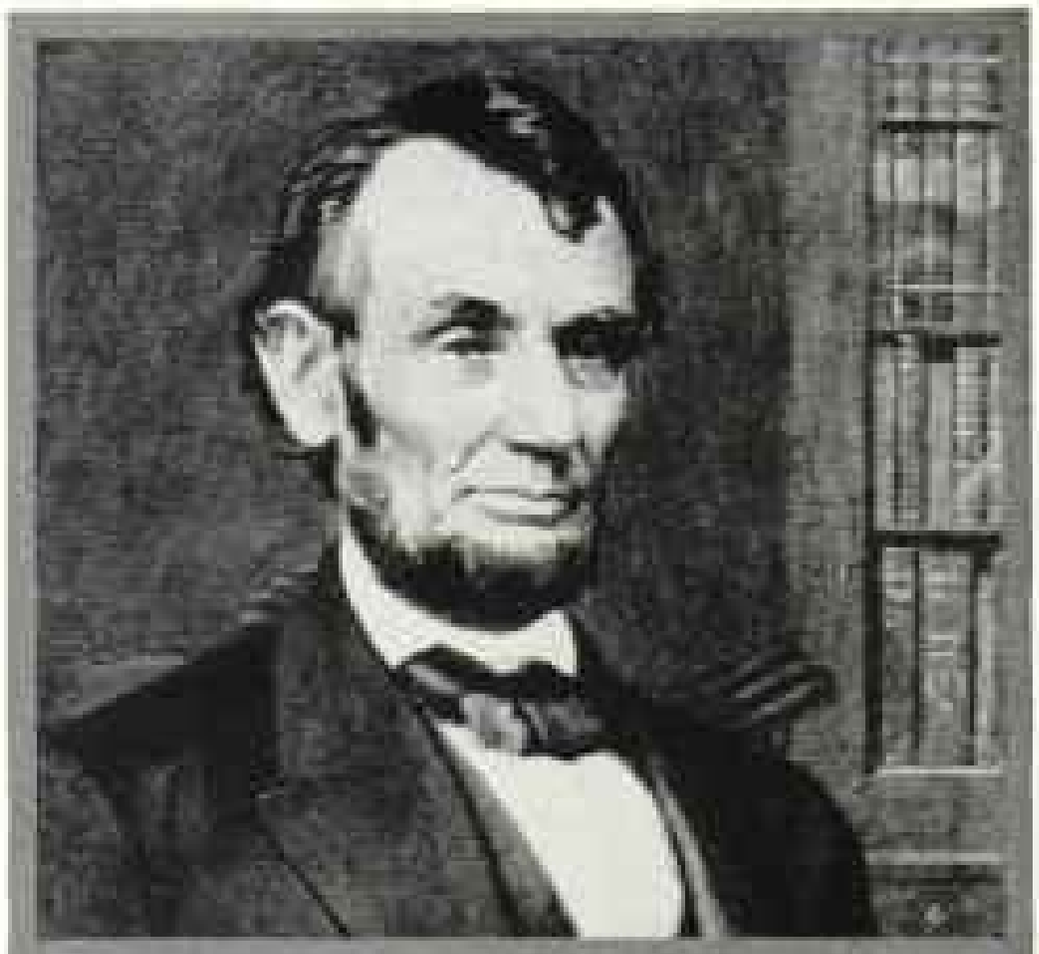

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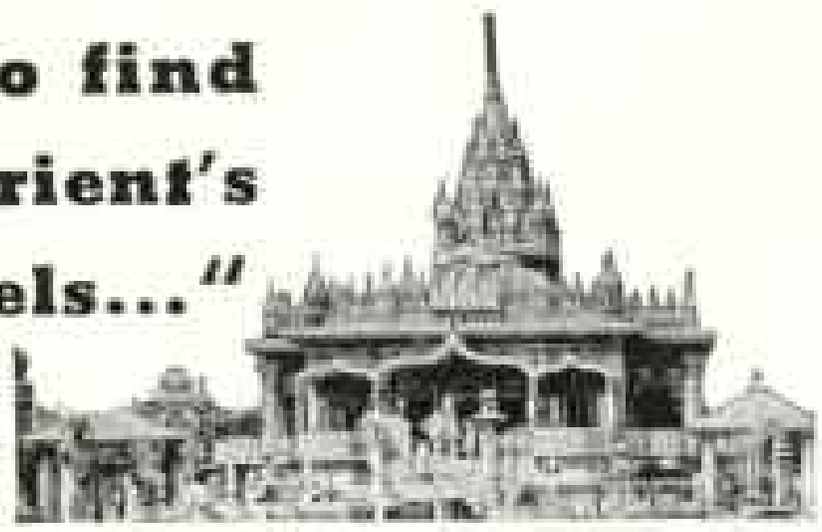

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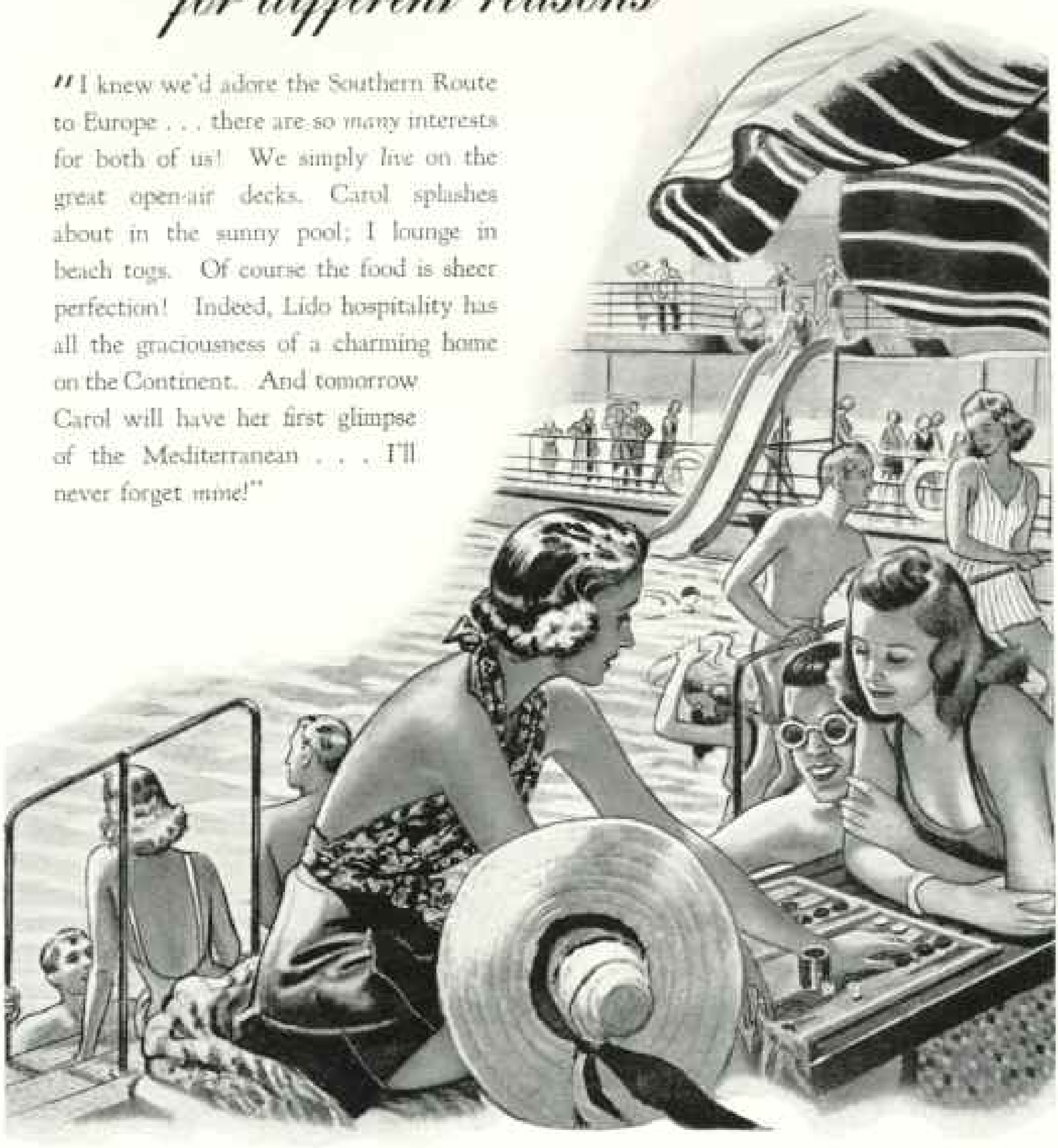

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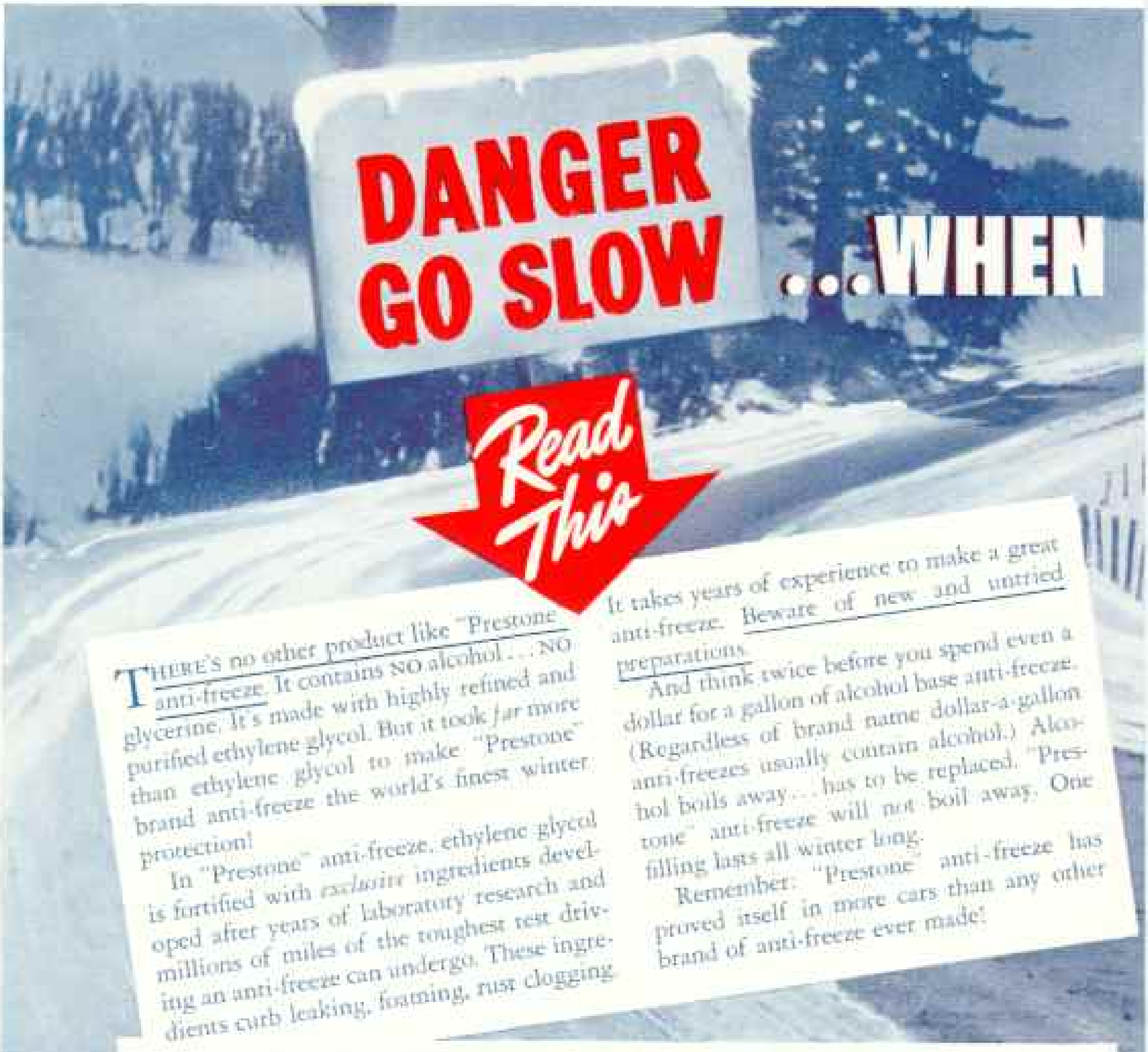

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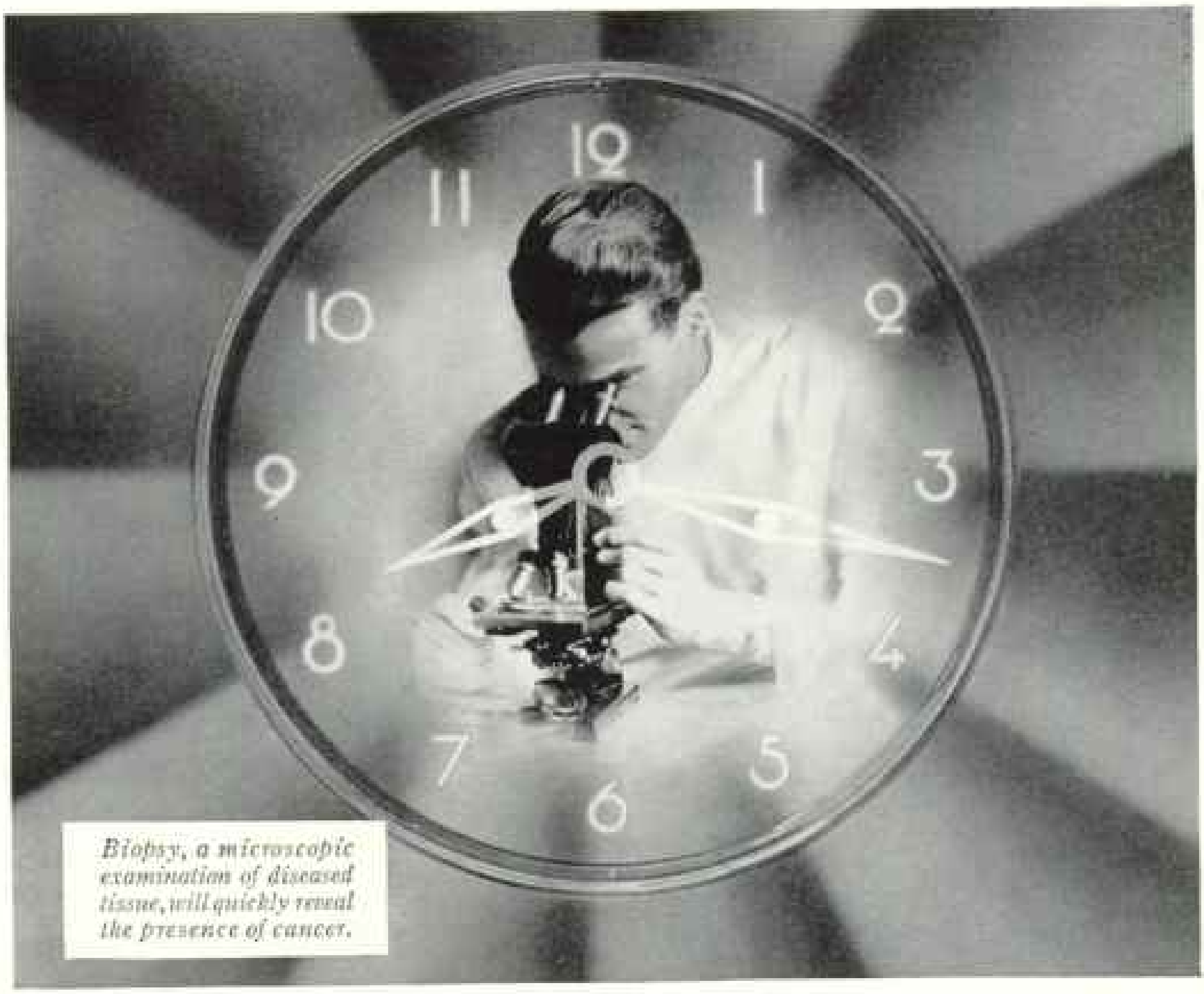

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DISCOVERED IN TIME — MOUTH CANCERS ARE CURABLE!

Most sore spots in the mouth are healed promptly by Nature. But if you have a persistent sore spot on your lip, tongue, cheek, or any other part of the mouth, you may be in urgent need of medical aid.

The presence of a swelling, lump or a strange white spot should arouse suspicion and be investigated. Sometimes a scientific test is made, a biopsy, in which a tiny section of the suspected tissue is taken for microscopic examination. If traces of cancer are found, no time should be lost in giving what may well prove to be life-saving treatment—X-ray, radium or surgery.

Though a mouth cancer may be small at first and sometimes hidden, it can usually be identified before it reaches an incurable stage. Medical studies have proved that many deaths from this form of the disease could have been prevented by prompt detection and proper treatment.

Self-treatment may be dangerous. A delay of even two or three weeks in caring properly for cancer of the mouth may cause another unnecessary death.

Mouth cleanliness is especially important in the prevention of cancer fatalities. Bad teeth should be cared for or removed. Jagged edges of teeth should be smoothed. Dental plates and bridges should fit comfortably. Some persons have a mouth condition known as leukoplakia—"white spot disease"—which, if untreated, may develop later into cancer. In these cases particularly the excessive use of tobacco and sharp condiments should be avoided.

Do not be misled by false claims that cancer germs have been discovered and special "cures" for cancer are available. The true and encouraging story about mouth cancer is that because of its accessibility it can be removed or destroyed when discovered in early stages.

Send for the Metropolitan free leaflet "A Message of Hope" which gives information that everyone should have about cancer. Address Booklet Department 1039-N.

PASSENGER PIGEONS

A century ago the great naturalist, James Audubon, observed this species in such abundance that he did not believe its numbers would ever be greatly diminished. Yet the last passenger pigeon vanished twenty years ago.

If the fate of an entire species is unpredictable, how much more so are the fortunes of an individual. That is why the wise man, no matter how abundant his fortunes today, prepares for adversities that may befall tomorrow.

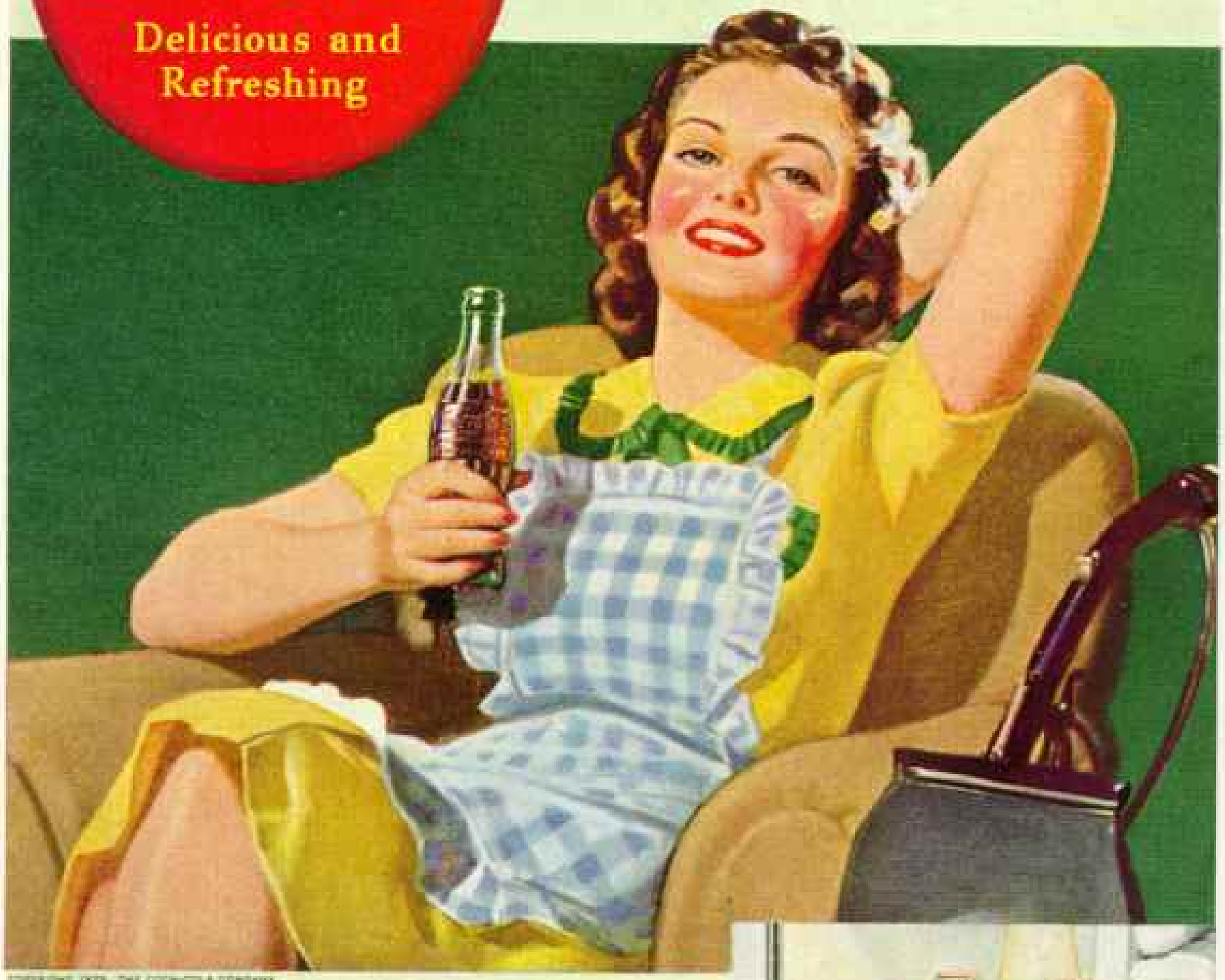
Drink

Coca-Cola

Delicious and Refreshing

The pause that refreshes

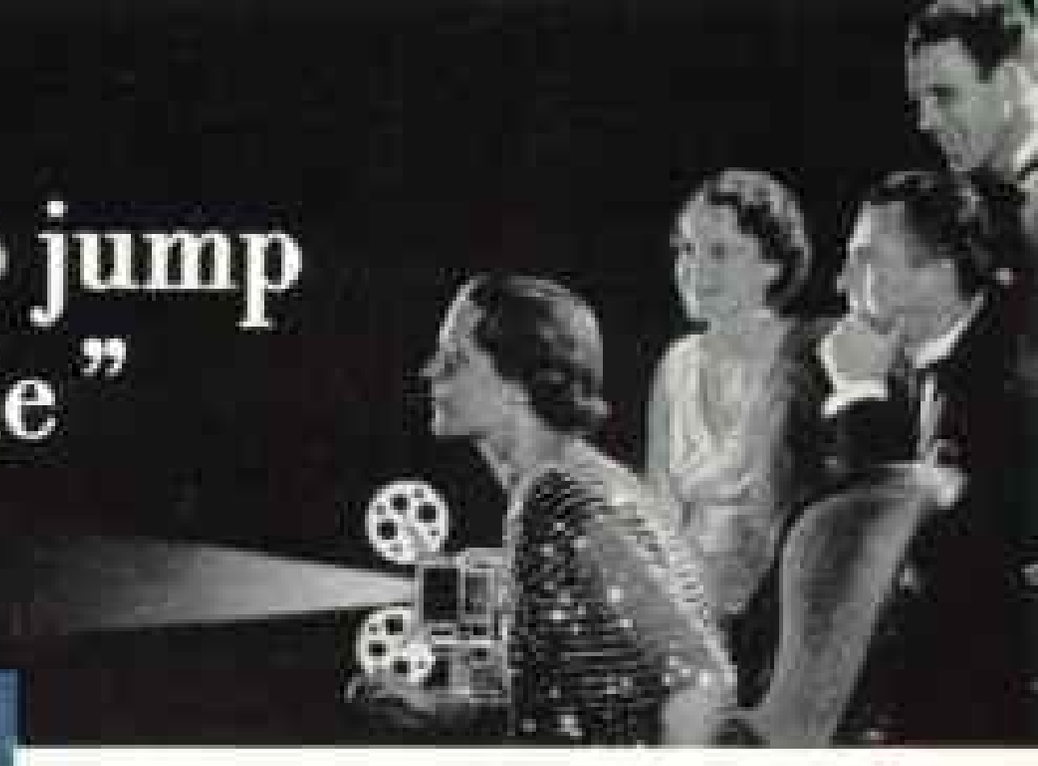
...at home



Housework brings that urge to pause and relax in an easy chair. Do it...with ice-cold Coca-Cola. It adds to relaxation what relaxation always needs ...pure, wholesome refreshment.

REFRESH YOURSELF WITH ICE-COLD COCA-COLA... FROM YOUR OWN REFRIGERATOR

"You almost expect him to jump right out of the movie"



FROM A KODACHROME ORIGINAL

SO extraordinarily real is the effect of light, color, and motion combined in Kodachrome color movies—you can hardly believe you're not looking at actual people, real earth and sky.

You are startled, enthralled—for although you are used to such scenes and lavish colors in nature itself, here on the home movie screen they become an entirely new experience.

If you haven't yet taken movies with Kodachrome Film—get started now. They're easy to take—just load your Ciné-Kodak with Kodachrome Film instead of black-and-white. That's all there is to it.

Ask your dealer to show you some of his sample reels. Only actually seeing them can give you any idea of their wonderful beauty . . . Eastman Kodak Co., Rochester, N.Y.

Kodachrome Film

EASTMAN'S FULL-COLOR HOME MOVIE FILM

All these movie cameras take pictures in Kodachrome as well as black-and-white:—You can use Kodachrome Film with any of the following home movie cameras: Ciné-Kodak Eight, the economy movie maker, Model 20, at the new low price of $29.50; Model 25, at $42; Model 60, at $67.50. Ciné-Kodak "E," the low-priced "sixteen" that has so many high-priced camera features, $39.50. Ciné-Kodak "K," the world's most widely used 16 mm. home movie camera, $80—the new low price. Magazine Ciné-Kodak, 3-second magazine loading, $117.50.

* DUES: Annual membership in United States, $3; Canada, $3.50; abroad, $4; life membership, $100. Please make remittances payable to the National Geographic Society. Please remit by check, draft, postal or express order.

RECOMMENDATION FOR MEMBERSHIP

IN THE

NATIONAL GEOGRAPHIC SOCIETY

**The Membership Dues, Which Are for the Calendar Year, Include Subscription to the National Geographic Magazine*

PLEASE FILL IN BLANK BELOW, DETACH, AND MAIL TO THE SECRETARY

1939

To the Secretary, National Geographic Society,
Sixteenth and M Streets Northwest, Washington, D. C.:

I nominate .....

Occupation .....
(This information is important for the records)

Address .....

..... *for membership in The Society.*

.....

10-39 *Name and Address of Nominating Member*

27 YEARS OF HELPING HOUSEWIVES

Sani-Flush was introduced 27 years ago with advertisements like this. Millions of women say Sani-Flush is the easiest and best known way to clean toilets. (Also cleans out auto radiators.) *See directions on can.* Sold by grocery, drug, hardware, and 5c-and-10c stores. 10c and 25c sizes. The Hygienic Products Company, Canton, Ohio.

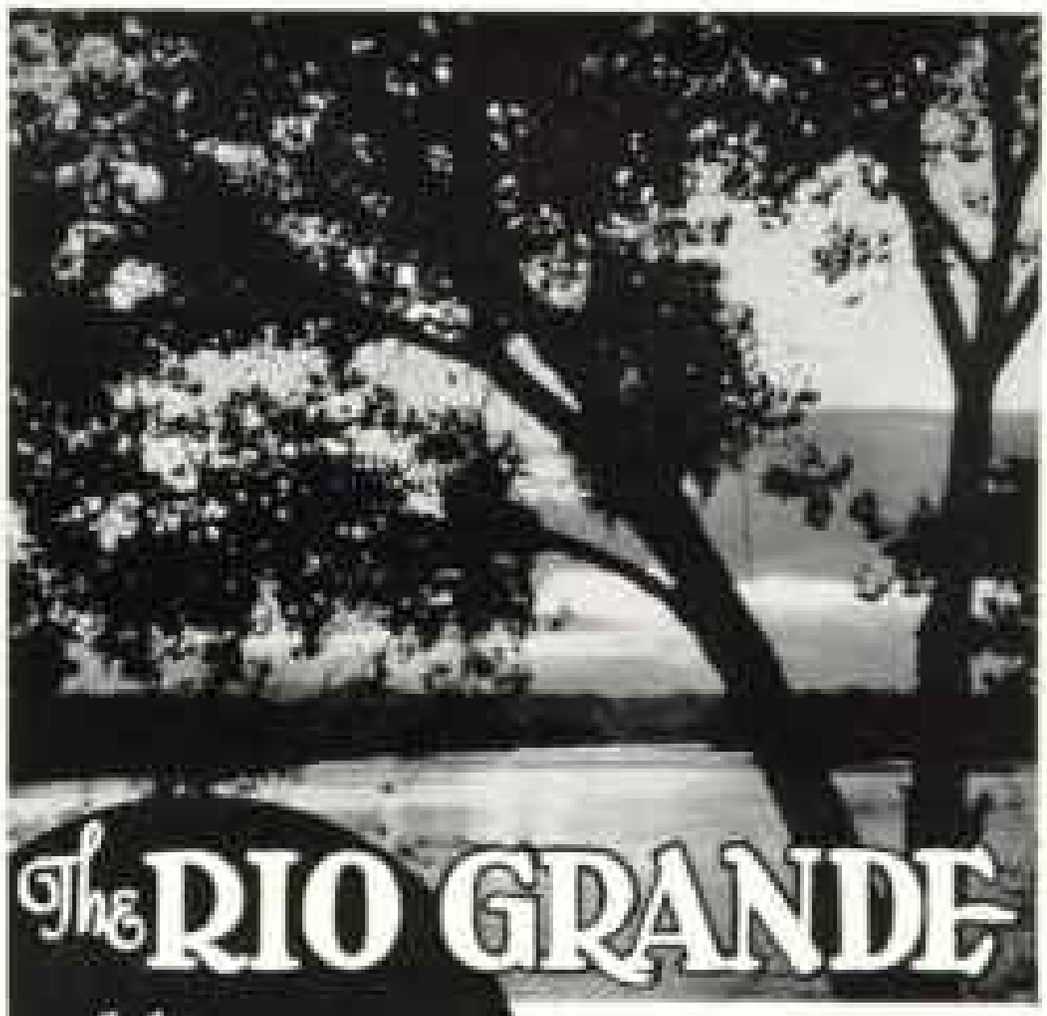
Champion-International Company

Manufacturers of the paper used in

THE NATIONAL GEOGRAPHIC MAGAZINE

and other high-grade coated paper

Office-Mill LAWRENCE, MASS.



A virile, romantic Old West on one side, glamourous Old Mexico on the other; and they meet in historic, modern El Paso—a city famed for its winter sunshine, its splendid accommodations, and for the scores of widely known beauty spots near by. Carlsbad Caverns National Park, White Sands National Monument, Elephant Butte Lake, high pine-clad mountains, colorful deserts and cattle ranges . . . . these are sights that thrill even the most seasoned traveler. Come this winter to El Paso; a stay of a few days or months will pay big dividends in health and pleasure. El Paso's new city and territory Fun Map outlines 17 interesting trips you'll enjoy. It's free to Geographic readers.

Hunters: Write for free folder on lion, bear, wild deer hunting in West Texas and New Mexico this season.

El paso

EL PASO COUNTY **Texas**

El Paso Gateway Club
Room 13 Chamber of Commerce Bldg., El Paso, Texas
Please send the 32 Page Fun Map and illustrated booklets
Playground folder to:

Name_____

Address_____

SUNSHINE PLAYGROUND OF THE BORDER

Another Letter of Interest to All Who Read
The National Geographic Magazine

Spring-Air

CHARLES KARR COMPANY
HOLLAND, MICHIGAN

August 8, 1938.

Mr. Raymond W. Welch
Director of Advertising
National Geographic Magazine
16th & M Streets
Washington, D. C.

Dear Mr. Welch:

When we used coupons as an important feature in our national magazine advertising, Geographic out-pulled all of the other magazines regardless of price per page. In addition to this, we received inquiries from any particular advertisement in Geographic longer from Geographic than from any other magazine. Best of all, however, we received letters inquiring about Spring-Air mattresses or accompanying checks for mattresses, in which people wrote us that they were sure that our products were all right in as much as our advertising was acceptable to the National Geographic Magazine. To my knowledge we did not get that kind of letter from any other magazine, and as you know I have been an advertising man and have spent millions of dollars in national advertising over a period of years.

It is of interest to our company that the National Geographic Magazine is kept and treasured by those who take it and also that it is read by a great many friends of your members, who, themselves, are not members and who do not receive Geographic directly. And best of all for advertisers such as ourselves, we find the Geographic Magazine on the tables in the finest professional offices throughout America and on the desks of the best hotel and hospital executives. Furthermore, the influence of the Geographic Magazine is not limited by factional disputes or feelings often caused by editorial matter found in other magazines.

National Geographic has another strong appeal to us. It is that Geographic is a family publication. Its appeal is not made to men any more than to women, and it is appealing to the children as well. Every member of the family finding an advertisement in National Geographic can and does recommend the advertisers of a product to all other members of the family and without the possibility of being misunderstood through what could at least seem to be prejudice.

Respectfully yours,
CHARLES KARR COMPANY

Charles D. Karr

Charles D. Karr, President.

CDK:KW

"Where shall we stay?"

ARIZONA

Phoenix

Hotel Westward Ho. Premier Hotel of the Southwest, in world-famous Valley of the Sun. Midtown with desert resort atmosphere. Am. & E. Plans. Pkld.

Tucson

Pioneer Hotel. Southern Arizona's Finest. 250 Rooms with bath. Europ. Coffee Shop. Dining Room. Roof Garden. Sun Deck. Sensible Rates. Booklet.

ARKANSAS

Hot Springs National Park

Arlington Hotel and Baths. Arthritis, circulatory benefits. Waters okayed and recommended by U. S. Govt. Golf, Fishing. Write for folder.

CALIFORNIA

Los Angeles

The Ambassador. Twenty-two acre Playground in heart of City. All Sports, Pirates, Beach, Lido. Cocoanut Grove for Dancing. European, $5.00 up.

Riverside

Mission Inn. California's historic hotel. In lovely Riverside. Art treasures. All sports. American or European Plan. Rooms $3.50 up. Write for Booklet.

Santa Monica

Miramar Hotel. Ideal winter location atop beautiful Palisades on the Pacific. Sports of all kinds. Hotel suites, bungalows and apartments with hotel service.

DISTRICT OF COLUMBIA

Washington

Continental Hotel. Facing the beautiful Capitol Plaza opp. Union Station. All outside rooms, some air-conditioned. Garage. Coffee Shop. From $2.50.

The Dodge Hotel. On Capitol Hill opposite Union Station Plaza. Celebrated cuisine. No tipping. Single from $2.50, double from $4.50. Direction K. F. Abbott.

Hay-Adams House, 16th at H. Opposite the White House. Completely air-conditioned. Single with bath from $5. Double from $8.50. Superb Cuisine.

Wardman Park Hotel. Washington's largest. 1000 outside rooms. Ample parking. Avoid traffic to all highways. Write for maps. Rates from $4.

MARYLAND

Baltimore

The Belvedere. Baltimore's most luxurious hotel. Modern appointments, spacious rooms, superior food and service. Convenient location. Rates begin at $5.50.

MASSACHUSETTS

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The Copley-Plaza faces beautiful Copley Square. Single rooms from $4.00; double from $6.00; Suites from $10.00. Arthur L. Race, Managing Director.

MINNESOTA

Rochester

Arthur Hotel. European $1.75 up. Fireproof—Modern—Comfortable. Cafe. Room Service Gratis. One Block to CLINIC. An Arthur L. Roberts Hotel.

MISSISSIPPI

Pass Christian

Inn By The Sea and Cottages, Pass Christian, Miss. Always open. On private bathing beach. All sports. Paved roads. Climate ideal. Near New Orleans.

NEVADA

Lake Tahoe—Glenbrook

Glenbrook Inn and Ranch. On most famous lake in West. Excellent golf, motoring, lake and mountain sports. One hour west of Reno on Route 50.

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Atlantic City

Chalfonte-Haddon Hall

Here full *value* means full *variety*. For diversion: concerts, dances, game rooms, squash, badminton, bicycle garage, golf, riding on the beach, varied entertainment. For relaxation: long Ocean Decks, seaside lounges, health baths, rolling chairs, superb food. On the Boardwalk. American and European Plans. Special attractions for children. Restricted clientele. Write for color folder.

The Claridge. The Skyscraper by the Sea. 400 large outside rooms, 3 sundecks. Solarium. N.Y. Off. 630-5th Ave. Circle 5-4600. G. R. Trimble, Gen. Mgr.

Hotel Dennis. October days by the sea are most alluring. Bathing, fishing, golfing. Attractive Fall Rates. Walter J. Buzby, Inc.

Marlborough - Blenheim. Central Boardwalk, overlooking ocean and city park. 31 years' ownership management. Josiah White & Sons Co.

NEW YORK

New York City

The Barbizon, Lexington Ave. (63rd St.) New York's most exclusive hotel for young women. Cultural environment. Wkly. $12.50 up, daily $2.50. Bklt. "G".

Barbizon-Plaza. New skyscraper hotel overlooking Central Park at 6th Ave. Rooms from $4 single, $7 double. Continental breakfast included. Bklt. W.

The Biltmore, Madison Avenue at 43rd St. All that is best in atmosphere, appointments, cuisine, service. Time-saving location. Illustrated brochure.

New York City

The Commodore—Right at Grand Central Terminal. Subway entrance in building direct to New York World's Fair. 2000 outside rooms with bath from $4.

Essex House, facing Central Park. Rooms and Suites with butler's pantries—from $5. 160 Central Park So., Cable Address—Essexho New York.

The Gramercy, on Fifth Ave. at 10th St. In smart Upper Washington Sq. Quiet, Convenient. 300 large rooms, single from $3.50, twin beds from $5.00.

Hotel Pierre, Fifth Ave. at 61st St. Overlooking Central Park in most fashionable location. Single rooms or suites by the day, month or season.

The Plaza. Facing Central Park. Air-conditioned rooms available. Subway at Hotel direct to the New York World's Fair. Henry A. Rost, President.

St. Moritz-on-the-Park. New York's only truly Continental hotel. Rumpelmayer's and Cafe de la Paix. Single, $4. Double, $6. Suites, $8.

Savoy-Plaza. Overlooking Central Park. Air-conditioned rooms available. Subway direct to World's Fair at the door—5th Ave. 58th to 59th Sts.

Hotel Seymour, 50 W. 45th St. Near Fifth Ave. Theatres, shops, art galleries. Radio City. Quiet, refined surroundings. $3 and $4 double, suites $8 and $10.

The Vanderbilt Hotel on Park Ave. at 34th St. A distinctive address. An internationally famous hotel. Single from $4, double from $7, suites from $15.

The Waldorf-Astoria. Park Avenue, 49th to 50th Streets. This is now the most extensively air-conditioned hotel in the world.

George Washington. 23rd St. & Lexington Ave. All rooms with bath, from $3.00 single, $5.00 double. Write for Bklt. "G" and uptown map of New York.

Watkins Glen

Glen Springs Hotel. High above magnificent Finger Lakes. Natural Sodium Baths. Splendid cuisine. Golf. N. Y. Phone GL 5-3201. Wm. Laffingwell, Pres.

PENNSYLVANIA

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Hotel Hershey. One of America's finest. Magnificent setting. Open year around. European and American plans. Four Golf Courses. All outdoor sports.

Philadelphia

Bellevue-Stratford—"One of the Five World Famous Hotels in America." Rates begin at $3.85. Claude H. Bennett, General Manager.

The Warwick. Famous Latour Cuisine. Centrally located. From $4.00 single, $7 double. George Lamade, Exec. Vice Pres., S. S. Jerman, Manager.

VIRGINIA

Virginia Beach

Cavalier Hotel and Beach Club. Open all year. Golf, tennis, riding, fishing, swimming pool. Roland Eaton, Managing Director. Write for Booklet "G."

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BERMUDA

Inverurie. Directly on the water: bathing, sailing, fishing. Attractive rates. Consult travel agent or Bermuda Hotels, Inc., Dept. N, 500 5th Ave., N. Y. C.

IT'S A GOOD INSTRUMENT TO

USE BECAUSE BACK OF IT THERE ARE

FRIENDLY AND COMPETENT PEOPLE SERV-

ING YOU . . . ABOUT 300,000 OF THEM

BELL TELEPHONE SYSTEM

PRESS OF
JOHN D. ENGELHARD, INC.
WASHINGTON, D. C.

RIDE IN QUIET. Nash's exclusive Super Shock-absorber-combine with Individual Front Wheel Springing quietly smooth the roughest road. New Sealed-Beam lights are glareless, yet 50% more powerful.

EVER FEEL THE FROST of sudden changes in the weather. Nash's exclusive Weather Eye keeps "balanced" conditioned air comfort always in the car. Automatic. No dust or drafts.

You Won't be Home Tonight

You'll see it pass like a ship in the night . . . a silent blur . . . a silver phantom. And you'll know by the sudden thump in your pulse—you've seen your first 1940 Nash!

You won't wait long.

But when you take the pilot's seat, hold on tight! For there's more power under this flashing hood than you've probably ever used before.

At throttle touch, the country outside becomes a crazy-quilt. Then a Fourth Speed Forward seems to shoot you forward on the giant shoulder of a wave.

When a car looms up ahead, just *nudge* the throttle, and you'll *sprint* by, in Nash's new dazzling Automatic Overtake.

Exciting? Yes—but *wait!*

Head for a road that's full of bumps. Then watch the hood ahead. See if you can make it bobble—try to feel a rise in that airy seat beneath you.

With a baby's grip on the wheel, you feather around sharp curves . . . walk a chalk-line on loose gravel.

Outside, a frosty wind is stripping the trees—but you don't feel it. Nor will you ever know cold, dust, or stuffy air again—thanks to the Weather Eye.

You're having your first Arrow-Flight Ride.

And when it darkens, just pull up—beneath a scarlet tree—and turn into your Nash convertible bed.

As a thousand stars wheel above, you'll forget about business and politics, in learning what living on wheels may be like!

. . .

Five minutes in a new 1940 Nash is more fun than a lifetime in ordinary cars . . . yet a Nash is as easy to own as any. Big as it is, it's priced with the lowest, and a Gilmore-Yosemite economy winner.

Give your Nash dealer those five exciting minutes . . . today!

EVEN LOWEST-PRICED models flash you from 15 to 50 MPH in less than 13 seconds, high gear. Fourth Speed Forward saves up to 20% on gasoline. Nash long-life means higher resale value. 1800 Nash dealers to serve you.

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IT'S THAT NEW