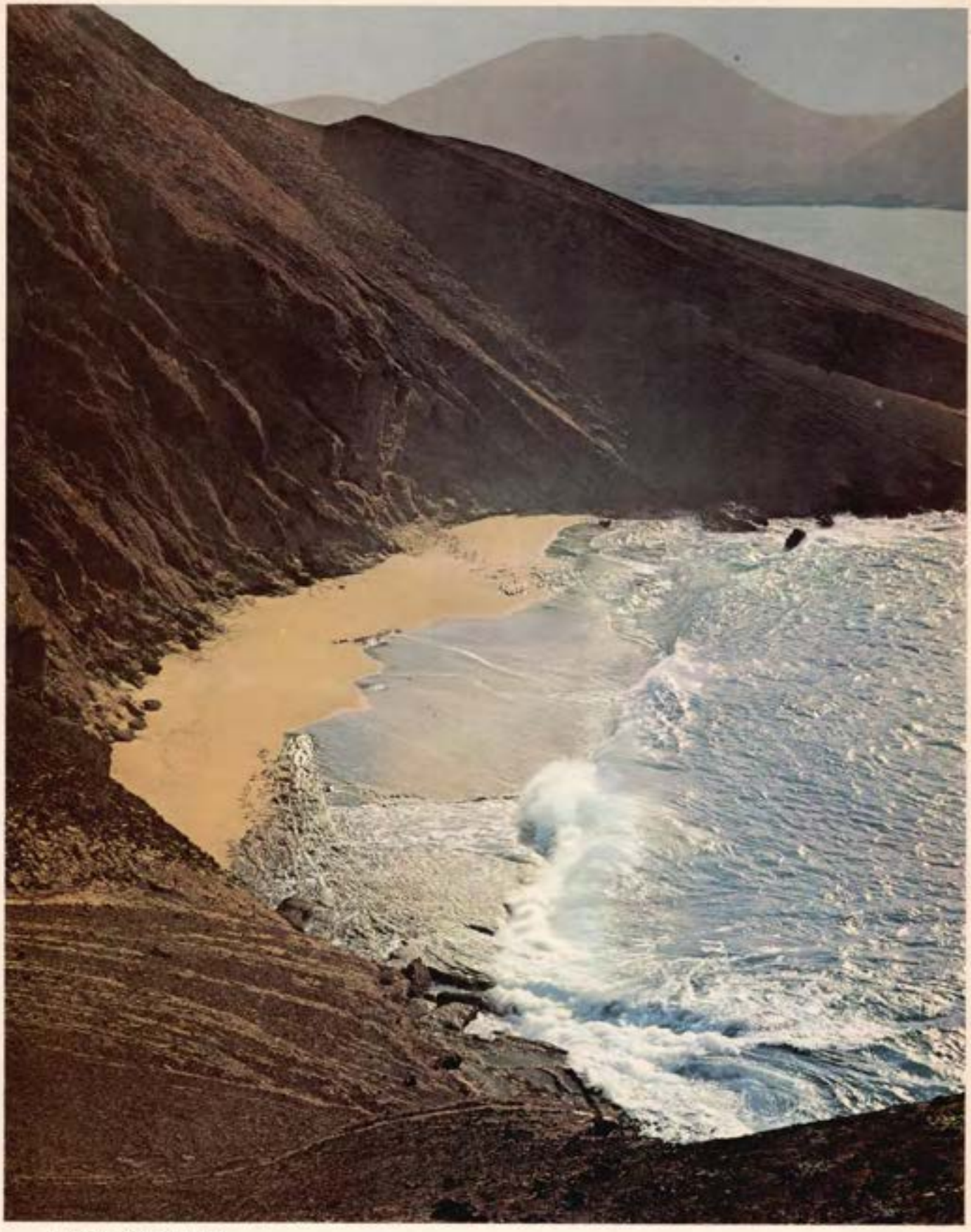

ELIOT PORTER: Galapagos

It is only a little planet . . .

Sierra Club Bulletin

Combined Annual Magazines 1966 1967 1968

As it descends across the American southwest, from the high parts of the Rocky Mountains down to the Gulf of California, the Colorado River slices off the southeastern corner of the state of Utah, just before it slides into Arizona. Here lies that part of the river called Glen Canyon. A trip down Glen usually starts where a dirt road crosses the Colorado at Hite, in southern Utah. Just a few miles upstream is the white water and foam of Cataract Canyon; but from Hite, for the next 170 miles, the Colorado flows so calmly that anyone can drift down the river, in any kind of boat. . . .

The Escalante River enters the Colorado 75 miles below Hite. The canyon is delightful walking in a few inches of water, flowing over a sandy bed. Escalante side canyons are among the finest in Glen Canyon. Soda Gulch enters through a spectacular slot. Its stream winds tortuously, several stream miles for each air mile. A short distance upstream at Gregory Natural Bridge, the stream has punched its way through a narrow rib of rock. Above it, Soda Gulch narrows, until, in places, it is only a few feet wide. The cool water is refreshing; for the desert above is quite hot. At several of the sharp curves, the stream has cut into the outside wall to form a deep alcove; one side of the canyon overhangs the opposite side, sometimes by hundreds of feet. Walking through such alcoves is an awesome experience. The walls have water seeps about their bases; flowers bloom and ferns grow there. Small pools collect under them, watering wild gardens, an Eden for the canyon wren and mourning dove.

Clear Creek is about three miles above the Colorado junction. It is wider than most of the side canyons; its floor is covered with dense green foliage. The small stream flows over a broad trough of bare rock. About two miles up from the river the walls suddenly close in. The floor of the huge chamber is smooth sand, in sharp contrast to the canyon outside. The stream comes down from the desert above in a strangely carved steep channel, and slides the last bit into a deep green pool. Maidenhair ferns band the walls around the pool. The cliffs almost join overhead to form the ceiling of a vast cathedral in the desert.

It is by this name that this place has been known—for the brief time it has been known. Those few who have known it consider Cathedral in the Desert the most beautiful spot in Glen Canyon. . . .

—from the soundtrack of *Glen Canyon*

(continued inside back cover)

Sierra Club Bulletin

VOLUME 52 OCTOBER 1967 NUMBER 9

To explore, enjoy, and preserve the Sierra Nevada and other scenic resources of the United States and its forests, waters, wildlife, and wilderness; to undertake and to publish scientific, literary, and educational studies concerning them; to educate the people with regard to the national and state forests, parks, monuments, and other natural resources of scenic beauty and to enlist public coöperation in protecting them.

JOHN MUIR, President 1892 to 1914

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Edited by DAVID BROWER

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Introduction

There is no special virtue in novelty, and we don't do things differently (erratically?) for the mere sake of being different. But sometimes it boils down to this: you must do something differently if you are to do it at all.

The Annual Magazine Number of the *Bulletin*—remembered fondly, we trust, by that half of the club's members who joined long enough ago to have seen the 1965 Annual—is a case in point. At one time or another in years past, the Annual has appeared in January, in December, and in every month between. Despite a certain, shall we say, flexibility, it has been customary for the Annual to appear with conventional frequency, that is, annually. This issue, however, is another first for the Sierra Club: so far as we know, it is the only triennial annual ever. If for no other reason, it should become a collector's item.

The triennial annual is an invention born of necessity (and one for which no patent is pending). Originally, it was intended to be the December 1966 *Bulletin*. But 1966 was a crisis year: the fight to keep Grand Canyon unmarred by unnecessary hydroelectric dams seemed almost lost; the struggle for a redwood national park took a bad turn when the administration ignored its own park planners' recommendations and turned its back on Redwood Creek; the campaign for a national park in Washington's North Cascades had to be brought to a boil in a hurry; and to cap it all, the club was forced to fight on another front when the Internal Revenue Service—less than 24 hours after we published newspaper ads alerting the public to Grand Canyon's peril—accused us of "substantial" legislative activity and threatened to revoke the club's tax-deductible status. It was a year when many things got done and many things, including the Annual, did not.

When 1966 skittered by without an Annual, the plot was to publish a combined 1966–67 Annual in 1967. Work on it proceeded, but proceeded slowly because issues that demanded attention in 1966 required undiminished attention in 1967 (and as the content of this Annual shows, are still very much alive today). Threats to Grand Canyon were less ominous than before, but we could not (and still cannot) breathe easily until the entire Canyon is protected within an enlarged Grand Canyon National Park. A redwood park bill providing for major acquisitions at Redwood Creek passed the Senate, but the Senate bill was inadequate and the House had yet to act. The North Cascades issue reached the legislative arena, finally, but again, a Senate bill needed improvement and the year passed without House action. The necessity of challenging the IRS tax ruling was made more burdensome by the ruling itself, which choked off large donations that had previously done much to sustain the club's programs. Dozens of other problems persisted and dozens of new problems arose. To keep a long story from getting any longer, 1967, too, passed without publication of an Annual.

But the triennial annual is here at last, And if the 1966–67 two-thirds of it is undeniably tardy, we can at least claim that the 1968 third is on time.

Librarians and other unfortunates who are confronted by the problem of indexing, binding, and keeping track of *Bulletins* may be relieved to learn that we intend, starting in 1969, to revert to the annual publication of Annuals. For the sake of these most dedicated of *Bulletin* watchers, we call attention to this Annual's place in the scheme of things. Technically, it is Volume 52 Number 9 of the *Bulletin*, dated October 1967. There was no Annual in Volume 51 (1966), and will be none in Volume 53 (1968).

As befits a triennial annual, this one contains more pages of text than its predecessors—and more pages of photographs, too, of which a greater number are in color. Writers and photographers who contributed to it bear no share of responsibility for making you wait for this Annual, only for making it worth waiting for.

Kenneth Brower edited a number of the club's Exhibit Format books: *Kauai, Navajo Wildlands, Baja California*, and a two-volume work on the Galapagos (in preparation for fall publication). The latter, like his story in these pages, grew out of an expedition sponsored by the club two years ago, of which he was a member.

John Milton was also a member of the expedition and has the pictures beginning on page nine to prove it. But he writes here of mainland rather than insular Ecuador. An ecologist, he now heads the new Office of International Studies of the Conservation Foundation. His equally authoritative coauthor, **Maria Buchinger**, is head of the Latinamerican Division of the Nature Conservancy, U.S.A.

Eliot Porter was also (you guessed it) a member of the Galapagos expedition. He led it, and his color photographs of the islands and their wildlife will illustrate the forthcoming Galapagos volumes. Best known for his *"In Wildness Is the Preservation of the World,"* Porter's other works include *The Place No One Knew: Glen Canyon, Summer Island*, and *Baja California*.

Hugh H. Iltis is Associate Professor of Botany at the University of Wisconsin. Although his fellow workers in the natural sciences have special knowledge, and for that reason, a special responsibility, he charges that they have lagged behind the general public in their efforts to insure the preservation of natural areas.

Charles D. Hessey, Jr., is a member of the board of the North Cascades Conservation Council, which has spearheaded the campaign for a national park in the Cascades of Washington State. The odds are that anyone claiming more intimate knowledge than Hessey's of the North Cascades and their trails is joking, bragging, or simply dreaming.

Michael McCloskey was the club's first field representative, based in Douglas fir country of the Northwest, until we brought him down to redwood country as the club's first Conservation Director.

Only two men have been President of the club longer than the present incumbent: Duncan McDuffie (six years) and John Muir (22 years). **Edgar Wayburn** and his wife, **Peggy**, have inspired and led the campaign for a redwood national park ever since the club became engaged in it.

David Brower writes of sedimentation problems in Colorado River reservoirs; he also planned, assembled material for, and edited this combined 1966–68 Annual.

Laurence I. Moss fought so effectively for Grand Canyon, and other things, that the club's Board of Directors nominated him for appointment as a White House Fellow. Later, he was nominated and elected to the board that had nominated him. The story may seem a bit too good to be true, but of course, Larry won appointment as a White House Fellow too.

Michael Williams is a mathematician at Los Alamos Scientific Laboratory, in New Mexico. He did much of the field work, on foot, that led to the Rio Grande Chapter's excellent report on Hooker Dam and its impact on the Gila Wilderness Area.

Morris K. Udall represents Arizona's Second Congressional District. He can be (but seldom has been) a formidable adversary; he can also be (and almost always has been) an invaluable ally.

Jeffrey Ingram, like Michael Williams, is a mathematician (and like Williams, he once worked at Los Alamos). He is now the club's Southwest Representative, working out of Albuquerque.

Lynn White, Jr., Professor of History at U.C.L.A., contends that Christian doctrine lends sanction to Western science and technology's assault upon the environment. Some readers may find this thesis uncomfortable, but they cannot dispute the authority with which Professor White discusses the interaction of theology, science, and technology. He earned an M.A. from Union Theological Seminary, won a Pfizer Prize for his work in the history of science, and won the Leonardo da Vinci Medal for his work in the history of technology.

Our final article is as readable and memorable an account of mountaineering derring-do as you are ever likely to see. While we cannot vouch for its absolute (or approximate) accuracy, we nevertheless recommend it without reservation to climbers, nonclimbers, anticlimbers, and the until now totally uninterested. It throws a whole new light upon the serious business of alpinism. If its authorship is not immediately apparent, it will be in the end.

—Hugh Nash

The editor of a two-volume work on the Galapagos, to be published by the Sierra Club in 1968, writes here of impressions formed while he was a member of the expedition the books resulted from. For other fruits of the expedition, see the color photographs in the picture sections that follow.

Fiddi, of Galápagos

»» Kenneth Brower

Visitors to the Galápagos Islands have three ways to get about: they can charter the "Beagle," a jackass brig owned by the Darwin Foundation research station, they can charter Miguel Castro's fishing boat, or they can charter the boats of the Angermeyer brothers.

The Angermeyers are German settlers who have been thirty years in the islands. The oldest is Gusch, a strong man in his fifties. He is married to an Equadorian woman and has himself come to look like an Equadorian bandit. Gruff and mustached, he's a little bit Falstaff and a little Anthony Quinn. He walks a slightly apelike walk, for effect, I think, and because of a back injury he received in his boat. The second brother is Carl, who much resembles the first—a little less roguish, but windier and more an actor. His walk is something like Gusch's, in his case because of a leg injury he received as a sixteen-year-old sailor in an African port. He and Gusch are just beginning to relax from the hard work the islands have required of them. The two older brothers, Carl especially, now enjoy long periods of laziness, and are happily becoming heavier and more bearish.

The youngest brother, Fritz, is the quietest, strongest, and most faithful of the brothers to the Angermeyer dream in coming to the Galápagos. Where his brothers are putting on weight, Fritz is lean; where his brothers have learned to use leisure time, Fritz has not. His shoulders are narrow but his arms are long and powerful and his hands huge, with great thumbs, wide in the last joint and with surfaces flat as anvils. The flexor muscles of his fingers have been so developed in years of work that he cannot straighten his right hand. His strength is admired and boasted of by his brothers, respected by the Equadorians, and for himself is a source of pride. He is slightly stooped from work and unattended sickness and his teeth are bad from lack of care. His skin is deeply tanned, not as skin tans in a summer at the beach but as it tans in a lifetime of work on the equator—as hide is tanned, permanently, a deep burnt sienna. He has a son, named Frederick after himself but called Fiddi.

As boys in Germany the Angermeyer brothers read *Robinson Crusoe* and *The Swiss Family Robinson*. From their father they learned to do anything they wished with tools, and they learned to sail. In their teens an old seaman told them of the Galápagos Islands, and they decided to go there. The brothers sailed from Germany as Hitler came to power, planning to become Robinsons in the Enchanted Islands, where they would make a home and then send for their parents. They were in their twenties, except for Fritz, who was nineteen. After adventures and tribulations—singing and playing for their keep in Denmark, going hungry and stealing apples in England, losing their boat and finally buying passage on a freighter—they arrived in the Galápagos.

The islands were not the paradise they had expected. Set with their provisions on the volcanic beach, they were downcast. "On this whole island," wrote Fray Tomás de Berlanga, the discoverer of the Galápagos, "I do not think that there is a place where one might sow a bushel of corn, because most of it is full of very big stones, so much so, that it seems as though sometime God had showered stones; and the earth that there is, is like dross, worthless, because it has not the power of raising a little grass. . . ." But Berlanga had come by accident; the brothers came by plan, which must have made their desolation more desolate. Herman Melville, who did not come by choice, wrote: ". . . the special curse, as one may call it, of the Encantadas, that which exalts them in desolation above Idumea and the pole, is that to them change never comes; neither the

change of seasons nor of sorrows. Cut by the equator, they know not autumn and they know not spring; while already reduced to the lees of fire, ruin itself can work little more upon them. The showers refresh the deserts, but in these isles, rain never falls. Like split Syrian gourds, left withering in the sun, they are cracked by an everlasting drought beneath a torrid sky."

Not all the islands wither in the sun. There is heavy rain in the highlands of Santa Cruz, where the brothers first settled. Bananas, plantains, lemons, oranges, grapefruit, pineapples, papayas, mangoes, chirimoyas, guavas, watermelons, coconuts, plums, figs, medlars, tamarinds, acerolas, potatoes, camotes, otoya, yuca, avocados, breadfruit, tomatoes, leeks, peppers, parsley, pumpkins, lettuce, coffee, sugar cane, maize, and tobacco all grow well there, but the same things grow on the mainland, where the market is, six hundred ocean miles away. Highland farmers make money only from cattle, and not much from them. It is a hard and frustrating life, and few of the Europeans who have settled in the highlands have stayed. Most of those who remain feel bitterly toward the land: it is much easier to love and remember nostalgically the heat and monotony of a place like Kansas than it is to love the wet highlands of Islas Santa Cruz or Isabella, where everything rots in the *garua* season and where the fight against burial by tropical greenness is unending. There is something insidious about a country where fecundity is the enemy.

When settlers went down, as the Angermeyers did, to live by the sea, they entered the country described by Berlanga and Melville, a country of lava, cactus, and the small, drab, ground-loving Darwin's finches.

It is a difficult country, where the goats must drink seawater and the finches drink blood, where the people drink rainwater collected on roofs or brackish water drawn from wells near the sea. Its edges are geologically recent and still rough, its history bleak, its waters dangerous, but, for a long time now, men of genius have been seeing things in it that normal men could not see. Charles Darwin noted differences in the island finches and he began the difficult, slowly culminating flash of inspiration that produced his theory of evolution. Miguel Castro, the son of an Equadorian fisherman, grew up among the birds and reptiles of the Galápagos and became expert on them. He learned more about tortoises and where they live than any other human knew, and is now Conservation Director of the Darwin Station. Melville left the islands and wrote *The Encantadas*. The Angermeyer brothers moved to the coast and became fishermen. They were looking for a place to live their boyhood dreams, which they saw no reason to abandon. With surf-worn lava stones they built their three houses on the low cliffs of Academy Bay, certain they were building in a better spot than the one they had left—Hamberg, where their parents, they learned, had been killed in an air raid—a better spot to raise their children.

Fiddi Angermeyer is fourteen years old. He has big hands and feet like his father and uncles. His toes lie in straight lines and are widespread, because most of his lifetime has been shoeless. His feet are the feet of an older person, for nothing has softened their contact with the volcanic soil and the splintered decks of fishing boats. The head gossip of Santa Cruz told me that the Angermeyers have peasant hands and feet and are embarrassed by them, but I don't believe it—they have served the family well in the islands and I don't think the Angermeyers are ungrateful.

Fiddi's skin has not yet adjusted to the equator and it freckles. He speaks German, English, and Spanish. His voice is changing and it often squeaks, especially when he is speaking German. He has seen no land but the Galápagos Islands and has never been outside their waters.

Once, when Fiddi was five years old, he and his father were sailing to San Cristobal, one of the larger islands, and his father gave Fiddi the helm. Fiddi was accustomed to steering with a tiller, but his father had just installed a wheel, and neglected to tell Fiddi about the difference. Fiddi turned the wheel away from the direction he wanted to go, as he had learned with the tiller, and found himself swinging off course. He leaned on the wheel harder and the boat swung farther off. When his father finally took the helm, the boat was turning tight circles and Fiddi was panicked and embarrassed.

But Fiddi was young then and there is now nothing he doesn't know about boats. He spends much of his time in the company of the little British Sea-Gull outboard motors that abound in Academy Bay. His normal posture is with the knees of his long legs tucked under his chin as he drives a dinghy about. He discusses hull lines and rigging like a ship designer, and if you ask him what he's going to be, he shrugs and says, "a seaman I suppose."

Our expedition chartered Fritz Angermeyer's boat, the *Nixe*, and Fiddi went along. The *Nixe* is a broad-beamed fishing boat built by Fritz and painted black from time to time by Fiddi. She is the tightest, best-built boat in Galápagos waters. Fritz fashioned each nail in her from copper wire. On our voyages in her Fritz navigated, his wife Carmen cooked, and Fiddi, the son, handled her single sail.

It was necessary that we hunt and fish for much of our food, and Fiddi and I were often together doing this. Of the members of our expedition I was the closest to Fiddi in age and was as bored as he was watching the photographers work. We were happier in island interiors with Fritz's bolt action, old, single-shot, rusty English .22.

Our first hunt together on James Island strained our friendship. I got close to a goat but Fiddi advised me I was not close enough for his father's old rifle. I moved closer and scared it. Angry at myself for not using my own judgment, I silently directed my anger at Fiddi. Sensing my anger, he became nervous and began a constant stream of advice and hunting lore and assorted inventive imaginings of how goats should be hunted and might be hunted. "Let's zigzag," he said, "so they'll think we're just walk-

ing somewhere," and he gave much other advice of the same worth. He didn't stop, even as I aimed at a second goat, and I missed. He continued until I told him to shut up, and we walked to the boat in silence.

We next hunted on San Cristobal, walking barefoot through the bush, finding goats, finally, in a bare rock ravine well up the side of a desert mountain. The goats, all males, perched easily on outcroppings above us, handsome under their curled horns, in their long beards and heavy chests, and their warning snorts were like rifle shots, echoing high in the ravine. After many bullets and a chase, I got a young goat. We climbed up to him and Fiddi, who had often watched his father butcher, quartered his first billy. "What a blood fight we had," Fiddi said of our struggle with the goat, who had kicked Fiddi after it was dead. "That billy was tough. He wasn't going to die." Fiddi used his father's knife, skillfully, and we descended with the quarters, which turned out to be the best we ever ate.

Later, hunting with Fritz on Indefatigable Island, something happened that changed my way of thinking about Fiddi. We came upon a large herd of goats, more than we had ever seen. Fritz's first bullet struck a billy high in the forehead, but it hit horn and hummed off. The billy just shook his head and ran off into the bush. Fritz shot twice more and got a female and another billy. The female was young and very fat with the green season, but she became trim as a greyhound after a quick operation by Fritz, who finished cleaning her and tied her legs together for carrying. Then he removed the billy's head and Fiddi picked it up by the horn. Fiddi shook it to impress us, but as he looked on the face, which was wise and dignified in death, as even a goat's face can be, Fiddi became guilty, and in his eyes I saw return the old hunters' regard for life and apology for taking it. He avoided the billy's dead eye and threw the head down, reverentially, it seemed to me, if that is possible.

From that time I thought about Fiddi's life, and in his company for the next three months, I became familliar with it. I understand how it is to grow up on one of the ends of the earth.

For Fiddi, it's lying on a fishing deck in the sun. The equatorial sun, which has bleached everything on the boat; the mast, the wheel, the deckboards, the once-black tar that caulks the seams and cracks. The anchor chain is lighter colored, though it's because of the rust, and the dolphins dying on the white of the deck lose their rainbow colors. Everything is faded but the living brown backs of the fishermen, his father's helpers. What shadow there is, is just a shade darker than in the full sun—it's canvas-colored shadow, shadow the color of an Equadorian straw hat. And from under his own straw hat, his eyes, the pupils stopped down by the brightness, bleach the remaining color from the world, and looking up, watch the colorless geometry of sail against barely blue sky. The yellow and red stains are gone from the canvas, and the sail strains and whipples in the wind. There are taut wrinkles at the edge of the canvas, and the shadows made by the wrinkles are as blue as the sky.

For Fiddi, waking under his blanket, it's the same deck at night. Everything then is simple and immense; the bowl of the sky and the dark plane of the sea, the angle of the milky way meeting the horizon. From under the blanket, face two feet from the black water and looking over the side, the prow strikes constellations of sparks, phosphorescent plankton, from the plane it is traveling, and the bow wave is milky with them. Behind, there is a phosphorescent wake and the dim figure of his father, motionless at the helm.

For Fiddi it's sitting in cool caves, on the sand, in the sweet smell of sea lion dung, watching the tide rise. Or it's sitting on the sand in the green-golden shade of the mangroves. Sand that is smooth, hard, golden-green in the muted light and not quite dry. The mangrove roots are good for sitting on. They rise a forest of stilts from the sand, and sometimes scarlet crabs feed about them, or marine iguanas rest on them, but not always, and often the mangrove shade is deserted. Mosquitos are bad there at sunset, but there are none in the day. The mangroves are never monotonous, as the deep forest can be, because they are only a thin strip where lava meets ocean. The forest is seldom more than twenty yards deep, and from the cool of it, sitting, you can see ocean one way and lava slope the other.

For Fiddi, it is catching green turtles and eating the steaks as his mother cooks them, or eating the eggs, raw, straight from the turtle. It is rejecting completely formed turtle eggs and selecting only yolks before the white has formed. It is leaning over the side of the boat, in case they drip, and biting through the membrane. It's sucking out the yolk, which sticks to the teeth as no chicken yolk does, and dropping the deflated membrane into the clear water and watching it sink, soon distorted from above but spotted from below by blowfish, who, rising, finish it.

It's finding in a tidepool the huge engine of a tuna boat he had heard about and finally discovered. It's standing on it in shallow water, hoping to salvage parts, though they are clearly rusted beyond recognition and possible usefulness; standing knee-deep in warm tidepool water and throwing pieces of rusty pipe and bearings at curious sea lions when they swim too close. It's waking in the morning to penguins calling, his eyes opening on dew in the hair of goat legs hanging from the stays, a drop for every bristle.

It's a hawk on a cactus above the blue Pacific, the wind in his feathers, the sun in his eye.

For Fiddi, growing up in the Galápagos has involved growing up in the little European settlement at Academy Bay. It involves his uncles Gusch and Carl and their stories, and Gusch's Equadorian wife Lucrézia, the most spectacular of the Angermeyer wives. It involves Lucrezia's graceful, twelve-year-old, full-blooded Indian muchacha with her wide Indian smile, and Lucrezia's two sons, the older

of whom, at seventeen, has his captain's papers and is now on a sailing ship somewhere beyond Tahiti. It involves the DeRoi family, who live by diving for lobsters and for shells which they sell to collectors of various mainlands. It involves the DeRoi children, Fiddi's friends though much younger, who know what shells to look for and have spent much of their new lives salty and wet. It involves his mother, Carmen, who has the finest collection of Galápagos shells anywhere, though Mrs. DeRoi comes close.

But in islands where boys his own age are scarce and where the waters are so prolific and the skies so full of bird life, it also involves animals, and they figure in his life as humans do. There are the albatross, with heads like chess-pieces carved from ivory—their jutting flawless brows, their stately walk, and sometimes the venerable yellowing of their neck feathers.

There are tropic birds in high afternoon skies, very fragile seeming, their wings white, translucent, and beating faster than those of any other bird in the Galápagos sky, their long tails following behind, white slivers in the blue. They look more like the crustacean, fluttering kind of thing you find in a tide pool, except that there is nothing wet or fishy about them. They are light and dried by high currents of air and the nearer sun, and blindingly white in it.

There are the great tortoises, hundreds of years old and strong enough for two men to ride. There are the land iguanas, the lions of the Galápagos bush. Big, tawny, heavy-headed, they lie in the mottled shade, relaxed except for the heads, which keep up a lazy vigilance; cool in the heat of midday and sleepy with the weight of a new kill, only here the kill is cactus pads.

There are the games you play with sea lions. One is to walk into the water near a bull who is cruising to guard his stretch of beach. You feign ignorance of his speed and wade into deep water. Pretending not to be concerned with you, he alters course and edges closer, but you are way ahead of him. You see through his game and he doesn't see through yours. At the last moment of his charge you splash away and run on up the beach. This is satisfactory and the chase over—he furious and you titillated—unless you want then to turn on the bull, insecure and slow-moving when he's on sand, and scare him back into the water.

Another game involves the fishing floats that wash up near the bulls on Galápagos beaches. While your friend distracts him, you snatch the floats from near the bull, and some are very near, so the game can be as dangerous as you want it. The best game if you're of a michievous persuasion is to lure a bachelor bull into the territory of a stronger, married one; to watch his confusion at crossing the line and his speed, when challenged, at leaving in the other direction.

There are the porpoises, leaping toward your boat from all quarters of the sea, their joyous angle of entering the water making the horizon cant toward you, their brotherhood telepathized to you, it seems, as soon as you see them at a distance. There are porpoises at noon, jumping high above the water and crashing flat onto it to rid themselves of parasites.

There are mornings before the sun has risen, the water calm and its most delicate blue, the horizon vague, the far sky and water pastel pink and blue, everything out of focus but your boat, a dark point and soft splashing in the unrealness, when suddenly many points and splashings—porpoises, making for you in their morning joy and pride at early waking and dawn fishing, racing to reach you.

For a boy with a long gaff, porpoises are most interesting when they have reached the boat and are pacing it, swimming easily ahead. Lying on the bowsprit he can lean down and scratch them, if his gaff is long enough, or he can just watch them. Sometimes they are twelve or fourteen deep, the deepest one just a light blue shape in the deep blue water but the higher ones so close that he can watch their eyes when they roll sideways slightly to look up at him, and he can clearly see the long white scratches where they have rubbed their backs against keels and other rough things.

Lying on the bowsprit he becomes conscious of their talk. At first it seems a high whistling in the rigging and he forgets it. But it is their voices, and when he realizes it, it fills his head. It's a disembodied sound, existing someplace above the water, seeming not to come from it. It's louder and clearer to a boy than to someone older. It's pitch is so high that the oldest men can't hear it at all.

In September Fiddi is going to Massachusetts, where he will go to school. In the Galápagos we worried about how he'll make it in so strange a place. Fiddi has spent his every waking moment under the equator learning things, but they are not things you need to know in Boston. He knows where the goats hide in the mornings. He knows that wild goats, who find little water, have less milk than house goats, and that for this reason it is cruel to chase them unnecessarily, and he will tell you so. He can explain how oystercatchers and the other birds that feed in the curlew manner know exactly what the surf is going to do—when it will break up high, when low, and that they hunt the sand accordingly, always staying at the edge of the foam. He can explain that they are infallible in this; that no matter how many times you are sure an oystercatcher has erred and will be inundated, the breaker that should get him collapses on itself for some reason and the bird is right. He has observed that gannetts flying in formation will drop instantly to the water on signal—a whistle from their leader—the order so nearly simultaneous with its execution that many instances must occur before a fisherman hears what is happening. He can talk in Spanish with youthful port captains of the Equadorian navy and with red-eyed, Negro-Indian sand carriers, but he has never had to talk with a school principal.

He doesn't know anything about cars, though he rode in an Equadorian army truck once. He uses words that may

not be acceptable to Massachusetts boys, words like "lovely." Once, when we were hunting for a hawk's nest high on the side of a worn crater, so high that the tiny lines of the waves below were only just perceptibly advancing, Fiddi stopped to watch the hawks above, and said, "It would be *lovely* to fly like that. I wish I could do it. But I would be satisfied to have a balsa glider and sail down just to that headland." I hope that this desire is familiar enough to Massachusetts boys for them to tolerate its expression.

Fiddi doesn't know much grammar or math. He is not over-familiar with evolutionary theory, though he was born in Darwin country. I once heard an ecologist in Fiddi's dingy think out loud in Darwin's manner: "I wonder," he wondered, "how these sharks came by their white fins?" Fiddi answered, "I don't know. I suppose they were born with them."

Fiddi's memories are of insular events that might not mean anything to Bostonians. His way of establishing chronology, for example: "Yes," he'll say, "that was when. It was the year after the eruption."

We worried about Fiddi and Massachusetts. His father thought he could make spending money there by building skiffs, but we had been to Boston and we guessed otherwise. We worried a little, but we joked with Fiddi about it:

"You better get used to turning the wheel in the direction you want to go," I said, "because that's the way you steer cars, and pretty soon you'll be tearing down the highway in one, at eighty miles an hour, a madman." Fiddi looked unhappy; clearly he had been worrying about this.

"I understand you don't have to drive a car," he said.

"But you'll want to," I told him, "to take girls to movies and dances—you'll want to do that." I told him what a success he would be with women—the wild man from the Galápagos, the primitive polyglot.

"Oh Fiddi," I said, in breathless girlish accents, "you mean you really sailed a fishing boat since you were five?"

"Oh Fiddi," Eliot Porter said, "you didn't really catch lobsters with your bare hands, and hunt goats, and catch turtles. . ."

Fiddi was embarrassed, but looked pleased, and I think I detected some anticipation under his straw hat and freckles.

But I worried about Fiddi. I saw him in a railroad station in that strange country, colder than he had ever been or thought he could be, his breath condensing as it never had before, his Lincolnesque hands and feet inadequately covered, maybe—and then I remembered what had happened to Lincoln in Illinois, to Darwin in the Galápagos, to Guaguin in Tahiti, to Thoreau at Walden. I remembered the place Fiddi had been, and what had happened to Crazy Horse in the Dakotas, to Buddha under the bo tree, to Mohammed and Jesus in the desert; and I realized, no need to worry about him, best to watch out for him.

Remember thy Creator in the days of thy youth. Rise free from care before the dawn, and seek adventures. Let the noon find thee by other lakes, and the night overtake thee everywhere at home. There are no larger fields than these, no worthier games than may here be played. Grow wild according to thy nature, like these sedges and brakes, which will never become English hay. Let the thunder rumble; what if it threaten ruin to farmers' crops? That is not its errand to thee. Take shelter under the cloud, while they flee to carts and sheds. Let not to get a living be thy trade, but thy sport. Enjoy the land, but own it not.

—Henry David Thoreau

Man and the Land in Ecuador

MARIA BUCHINGER AND JOHN MILTON

The United States and other highly developed countries have been spending vast sums on widely varied foreign assistance, all too often motivated by short-range economic criteria and giving little consideration to social, ecological, aesthetic, and long-range economic impacts of development projects. Seeking to improve this situation in his own way, Eliot Porter in early 1966 organized an expedition, assisted by the Sierra Club, to Ecuador's Galapagos Islands. Two exhibit-format volumes based on that trip are now in preparation. This project marks an important step forward in the Sierra Club's contribution to worldwide conservation. The books on the Galapagos, and the Club's earlier support of two officials from the Ecuadorian government who attended a national park training course in Michigan, are examples of the kind and quality of effort now needed to counteract the rapid destruction of wilderness abroad.

Greatly expanded efforts will be needed to counteract successfully the adverse effects of much of our own country's massive governmental and private "development" programs throughout the world. We hope more North Americans will take heed of environmental problems in developing nations like Ecuador. At best this will lead to an accelerated support of local conservation activities—in Ecuador and wherever similar local efforts exist in the "underdeveloped" world. Moreover, in the excitement of watching our own technology change the face of our part of the Americas, we have overlooked some important lessons abroad. Increased contact with other countries like Ecuador will often permit us to learn from those who have already worked out an enduring relationship with the land. The "underdeveloped world" has much to teach us about means for environmental conservation

—M.B. and J.M.

ECUADOR IS A LAND of great contrasts; the Andes bisect the country from north to south, and the equator, as the country's name implies, crosses east to west just north of the capital city, Quito. Much of Ecuador's natural and cultural diversity results from its location and topography.

It is a small country—only Uruguay is smaller in South America—yet there are four distinct environmental regions: the Coast, the Sierra, the Oriente, and the Galapagos Islands. The Coastal zone, largely an alluvial plain (12 to 100 miles wide) west of the Andes, provides many export products (bananas, cotton, cacao, rice, sugar, and coffee) and is the site of Ecuador's largest city and chief port, Guayaquil. The coastal climate tends to become progressively drier from north to south.

The Sierra is actually two roughly parallel ranges. A dozen mountain peaks are higher than 16,000 feet and the almost perfect cone of Cotopaxi reaches nearly 20,000 feet; even higher is Chimborazo, first ascended in 1880 by the British climber Edward Whymper. These immense mountains are overwhelming, glaciers gleaming above the dark, massive bulk of convulsed and creviced foothills. Humboldt called the two long ranges of cones and their intervening valley the "Avenue of Volcanoes." Indeed, most of the higher peaks are volcanoes and some are still active. A chain of intermontane basins, about 390 miles long, stretches between the two Andean ranges, gradually descending toward the south from roughly 9,500 to 7,800 feet. Quito is in the northern part of this elevated region and forms a focal point for many products of the Sierra, particularly potatoes, corn, pyrethrum, wheat, barley, beans, cattle, and sheep.

The Oriente zone slopes down gradually eastward from the Andes to the broad flatlands of the upper Amazon basin. Large portions of this territory have been lost to Ecuador since the Spanish colonial period, and now the country is almost entirely cut off from navigable sections of the major Amazon tributaries. Most of the Oriente is still true wilderness; there is little access by road or boat and vast stretches of tropical rain forest dominate the landscape.

The fourth major region, the Galapagos Islands, is unlike any other part of Ecuador. Indeed, these volcanic islands resemble no other major island group in the world. The Humboldt current cools their equatorial shores and is primarily responsible for a band of semidesert in lower

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JOHN MILTON: Sullivan Bay, Bartholomew Island

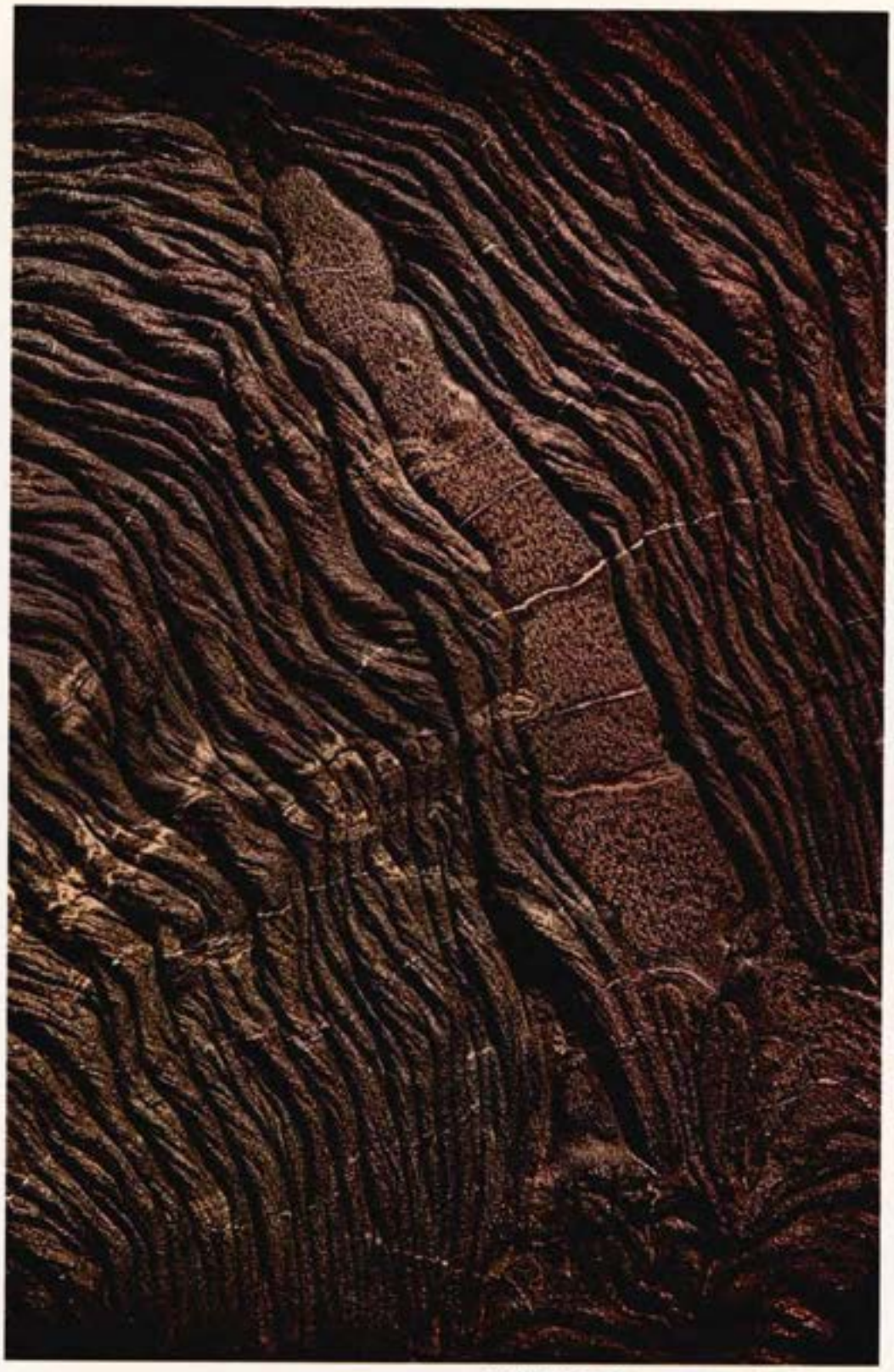
Galapagos

When man obliterates wilderness . . .

JOHN MILTON: Sally lightfoot crab

JOHN MILTON: Land iguana

. . . he repudiates the evolutionary force that put him on this planet. . . .



JOHN MILTON: Lava pattern, Sullivan Bay

In a deeply terrifying sense, man is on his own.

—J. A. Rush

elevations of the archipelago. The uplands, which receive more rainfall, tend to be covered with a richer cloak of vegetation. On these isolated islands an incredible diversity of plants and animals has evolved, many forms found nowhere else. Still relatively unaffected by man, this unique island group is priceless, both as wilderness and as a scientific resource; such wild areas hold, as Nancy Newhall put it, "answers to more questions than we yet know how to ask." To help preserve these qualities, the Ecuadorian government has wisely set aside all unsettled portions of the Galapagos as a National Park.

Ecuador's diversity of landscape is remarkable, and so is the country's variety of peoples: the heterogeneous mixture of Caucasian, Indian, Negro, mestizo, and mulatto are bound together only loosely by Spanish culture and language. A census in 1962 showed, out of a total population rapidly approaching 4.5 million, nearly two-thirds were living in rural areas or towns of less than 2,000 people. The present annual rate of population increase is 3.1 percent, which, if maintained will lead to a doubling of the total population in 23 years. About half of the Ecuadorians live in the Sierra, and almost that many are living in the Coastal zone; the Oriente and Galapagos together include less than 1% of the nation's total population. Ecuador's pattern of cultural diversity is every bit as complex as its pattern of changing landscape—and, in fact, both patterns are intimately bound together. It is against these two contrasting patterns—one of nature and the other man—that any understanding of man's use and misuse of the land must be measured.

No one exposed to Ecuador's snow-capped volcanoes, tropical rain forests, and rugged seacoast and islands could fail to be impressed by their magnificence. Both of us were soon persuaded that "something ought to be done" to preserve examples of this superb wilderness. Our conviction had already been shared by many Ecuadorians. Thirty years ago resolutions were presented to the National Congress for establishing a national park along the line of the Equator—from the coast, across the Andes, and through the Amazonian forest. Efforts to conserve the cinchona (quinine) forests can be traced back to the last century. It was no consolation to find out that many visiting scientists and travelers were also giving ample and often superfluous advice after brief visits. We felt and feel that Ecuador needs help to encourage and amplify further the excellent work already being done by local conservationists.

The Pre-Colonial Period

The earliest known efforts in resource conservation were achieved by the pre-Hispanic Indian cultures of the central Andes. Of the major centers of complex civilization in the Western Hemisphere prior to the Spanish conquest, the Andean region displayed a particularly sophisticated attempt to harmonize its technology with the long-range requirements of the land. Unlike the Maya culture, which flourished for a time in the lowland rain forests of Middle America and then faded, the pre-Columbian Inca society demonstrated a deep concern for the care and conservation of its natural resources; one measure of its success was the sustained vigor of Inca land-use patterns, which were successfully maintained up until the time of the conquest.

The seat of the Inca government was in Cuzco, in what is now Peru. A later secondary center developed at Quito. Within this tightly integrated empire, the Incas undertook an impressive series of resource-development projects, emphasizing mining, irrigation, soil fertilization, control of erosion, plant and animal domestication, and conservation of highly-valued species of wildlife. An example of Inca efforts to improve their agriculture is described by Furlong (1948), a Latin American historian who noted that the natives not only used potatoes, but also carefully studied how best to cultivate them: "The Inca, Urion, who would be by modern standards an engineer, architect, and agronomist, studied the soils of Quito, particularly those in which the best potatoes were being grown. He then took several tons of this soil to Cuzco, Peru, to improve the cultivation of potatoes there."

The Incas established a wildlife preserve on the guano islands off the Peruvian coast; the guano from these islands was highly prized as fertilizer, and the punishment for killing any of the guano birds was death. The Incas also were highly skilled in the terracing of agricultural slopes to prevent erosion. They developed a land-use system in the high Andes that depended largely on a centralized economy, and on growing products specialized to the climate and soils of the various regions. These products, through exchange, served the entire Inca economy and allowed high population densities to build up throughout the Inca Empire. After the Spanish conquest, much of this pattern was disrupted and agricultural communities tended to be smaller and self-sufficient. Unfortunately, many practices harmful to the environment over the long run were then instituted to sustain high levels of population. To this day, much of the Andean region has been unable to regain the successful balance of resource utilization of former days. Erosion, overgrazing, and nutritional problems have often been the bleak harvest of this latter-day neglect of ecological guidelines.

The Colonial Period

Francisco Pizarro defeated the Inca Atahualpa in 1552, a date marking the beginning of Spain's rule, which lasted until 1822. During the Spanish conquest, priests and doctors attached to expeditions described the environment of the new world, but usually observed it with a strong European bias. They interpreted their experience of a totally new land in the context of earlier European training; plants were described as "similar to oaks" or "similar to beech-trees."

In the beginning of the nineteenth century, an objective and comprehensive study of the Ecuadorian landscape was undertaken by the German naturalist, Alexander von Hum-

boldt, who explored the country in the company of Ecuadorians. They were stimulated by this contact and translated Humboldt's work into Spanish. Francisco Jose Caldas, a genial Ecuadorian scientist who had joined Humboldt on many field trips, continued to follow up Humboldt's ideas, elaborating and deepening them. From 1807 on, Caldas wrote about Ecuador's climate, pasture lands, and the use of honey and quinine; he analyzed the plant geography and physical aspect of the Andes. In the introduction of his *A Project for Plant Geography*, Caldas stated: "Even if description is of the utmost importance for natural history . . . it is not less important to fix our attention on the geography of plants, a sublime science about which we now know scarcely more than the name, but which nevertheless forms an integral part of the physical world. This is the science which considers plants in relation to their local associations and different climates." Many of Caldas' writings foreshadowed the twentieth century emphasis upon the study of Andean ecology. Unfortunately, Caldas did not finish his planned comprehensive geography of Ecuador. He was executed in June 1816 in his country's fight against the Spanish Crown.

One other Ecuadorian of considerable influence on the history of land use in Ecuador was Vicente Rocafuerte. In the early 1800's he presided over the country's government and created a school of agriculture. "The number of lawyers," he said, "is rising to infinity, and they are a veritable plague in a country as ill civilized as ours . . . yet we have no agronomists." Rocafuerte's work did much to correct this situation.

The Galapagos Islands

While scientists were exploring the South American mainland, "the Galapagos," an island group six hundred miles west, was being used as a refuge by buccaneers and whalers. The archipelago's unique and interesting plants and animals suffered tremendous damage at the hands of these men. Two factors were of prime importance in this degradation of the islands' ecosystems: the introduction of exotic species and hunting and collecting for food and "sport." Goats, cattle, donkeys, mice, rats, dogs, cats, and a wide variety of plants were introduced, resulting in severe impacts upon native species.

Under these pressures, which continued at high levels through the 17th, 18th and 19th centuries, the native plants and animals declined rapidly. After Darwin's famous visit to the islands in 1835, there was a subsequent rapid rise of world interest in the Galapagos that further promoted destruction of its wildlife. The Galapagos tortoise *(Testudo elephantopus)*, after which the archipelago was named, was especially hard hit. G. Baur, a geologist who visited the islands in 1891, estimated (probably an overestimate) about ten million specimens had been removed by then for their meat and oil. Out of some eleven islands where varieties were once known to exist, the tortoise is now found on only six; on three of these islands it is very rare. In the twentieth century, collectors for zoos and museums further decimated the natural environment that was also suffering from destruction of habitat and hunting by settlers, whose numbers were increasing. The flightless cormorant, Galapagos penguin, land iguana, and fur seal were among species that became seriously endangered.

In 1934, the Ecuadorian government (which had had the islands in its possession since 1832) was so alarmed by the critical situation that it established nature reserves in several sections of the archipelago. This action was primarily the consequence of a governmental survey led by Frederick Perez and encouraged by the Ecuadorian Central University. Unfortunately, however, at that time few provisions were made for enforcement of the executive decree. Subsequently a number of learned Ecuadorians, including Dr. Cristobal Bonifaz Jijon and Dr. Misael Acosta-Solis, began the drive for establishment of a biological station on the islands for the study of native plants and animals and for conservation purposes.

Twenty-three years later, in 1957, a group of organizations interested in the conservation of the Galapagos (The Conservation Foundation, International Council for Bird Preservation, International Union for Conservation of Nature, *Life* Magazine, New York Zoölogical Society, and the United Nations Educational, Scientific and Cultural Organization) sponsored an ecological reconnaissance of the islands. As a result of this survey made by Dr. Robert I. Bowman and Dr. I. Eiblesfeldt, and their subsequent reports, the Charles Darwin Foundation for the Galapagos Islands was founded in 1959. The Foundation's major objectives are to advance scientific knowledge of the Galapagos archipelago and conserve its biota; the Foundation is an international institution operated in coöperation with the Ecuadorian Government and UNESCO.

In the same year, 1959, the President of Ecuador, Camilo Ponce Enriques, incorporated all remaining lands not then occupied by settlement into a "Galapagos National Park" and instituted laws giving complete legal protection to nearly all the endangered fauna. In January 1964 the members of the Junta Militar de Gobierno signed a decree agreeing to establish a biological experiment station in the islands; the station's primary duty was to carry on studies leading toward the preservation of the archipelago's biota and life in the seas around it.

The establishment of the Charles Darwin Research Station was enhanced by the simultaneous inauguration of the Galapagos International Scientific Project. This well-organized expedition brought together more than fifty scientists from many nations to undertake a diverse series of investigations. There have already been two direct consequences of the project: a steadily mounting use of the research station by visiting scientists, and publication of the expedition's interdisciplinary symposium on biological and physical evolution in the islands. This volume of the proceedings, *The Galapagos*, edited by Dr. Robert I. Bowman, provides an excellent introduction to existing scien-

tific studies on the archipelago through 1963 and sets forth important guidelines for future research. It is hoped the book will encourage more long-term studies, particularly where important gaps exist in our understanding of animal behavior and plant and animal ecology; such research should provide a vitally needed basis for defining future conservation activities in the Galapagos Islands.

Since its inauguration, the Darwin Research Station has made great strides in furthering Galapagos conservation. Mr. Miguel Castro, the hard working and knowledgeable warden, and Dr. Roger Perry, the present Director of the Station, have made significant progress in controlling settlements, halting the spread of introduced plants and animals, curbing poaching, encouraging conservation education among the settlers, and promoting special activities related to preservation of particularly endangered species.

Scientists, conservationists, photographers, and writers from all over the world are now visiting and using the research station's facilities. Their studies, films, books, and articles have done much to stimulate world concern for the future of this unique island group. Unfortunately, however, much of this valuable information is never brought to the attention of the Darwin Foundation and the Ecuadorian authorities, who have primary responsibility for conservation legislation and its implementation on the islands.

In 1966, the Sierra Club, in coöperation with the Government of Ecuador, the Conservation Foundation, and the International Union for the Conservation of Nature (IUCN) Latin American Committee on National Parks, culminated three years of effort with its five-month expedition to the Galapagos. This project was initiated and led by Eliot Porter, a director of the club who had previously contributed three books in the club's distinguished exhibit format series.

The books the Sierra Club plans on the archipelago will be the first to emphasize the islands' remarkable ecological diversity of habitat and their native biota through the use of the kind of color photography that has made Eliot Porter preëminent in his field. It is to be part of a group of books within the series that celebrate the remarkable complexes of living communities and life forms that man has hardly learned to understand and that his technology is threatening with oblivion. If the Galapagos book is translated into Spanish, as is intended, its influence on the Galapagos National Park should be profound; many Ecuadorians who would otherwise have little basis for appreciating the islands' importance will understand the unique natural values of the area—and the need for conservation.

The successful preservation of the Galapagos as wilderness depends to large degree on how well Ecuadorian national pride and interest in the archipelago is stimulated. Unless this sense of wilderness, and its importance to man, is carefully nurtured in each culture according to its own historical perspective and evolution—the effort to save those natural wildernesses still left in the world will certainly fail. Seen in this context the Sierra Club Galapagos volumes may well be among the most important ones it has published for furtherance of international conservation.

New Attitudes

To a certain extent, the establishment of the Galapagos National Park was also a result of the 1940 Convention on Nature Protection and Wild Life Preservation in the Western Hemisphere. The preamble of the Convention states the desire of: "The governments of the American Republics . . . to protect and preserve in their natural habitat representatives of all species and genera of their native flora and fauna, including migratory birds, in sufficient numbers and over areas extensive enough to assure them from becoming extinct through any agency within man's control; and . . . to protect and preserve scenery of extraordinary beauty, unusual and striking geologic formations, regions and natural objects of aesthetic, historic or scientific value, and areas characterized by primitive conditions . . ."

Ecuador was one of the first countries to sign and ratify the Convention.

In 1940 Dr. Misael Acosta-Solis founded the Ecuadorian Institute of Natural Sciences. The Institute's central objective has been to keep Ecuadorians aware and alert to conservation problems. Through publications, news releases, organization of round-table discussions, and symposia, the Institute continues to promote conservation projects and disseminate public information.

In the years 1964 and 1965, much world attention was focused on conservation matters. Many countries revised their conservation legislation and resource administration. Ecuador followed this trend and reorganized its governmental administrative structure; the offices dealing with renewable natural resources received special attention through both increased budget and more personnel. In addition, the Forest Service was asked to help initiate programs in wildlife and national park conservation.

In 1964 Guayaquil was host to the Symposium on Conservation in Latin America with Special Reference to Science, Conservation, and Economic Development of the Galapagos. Despite Guayaquil's inhospitable March weather, the Symposium was enthusiastically attended by the public.

The first official meeting of IUCN's Latin American Committee on National Parks was also hosted by Ecuador in Quito during 1964. His Excellency, the Minister of Foreign Affairs of Ecuador, in his closing remarks officially recognized the need for better international cooperation in the field of Latin American conservation. Problems in providing improved training of park and resource personnel were emphasized at the meeting.

In 1965, a short course for training park administrators was organized at the University of Michigan. When the course was announced, Ecuador expressed strong interest in participating. A small grant from the Sierra Club enabled two Ecuadorians to attend. Ingeniero Teodoro Suarez,

Chief of Forest Management (and also in charge of National Parks) was accompanied by the head of the city park system of Quito, Ing. Espinosa. Both obtained much useful information and a new perspective on the possibilities for further extension of the National Park System in Ecuador.

Ecuador has also been active in supporting other hemispheric efforts in conservation. The Organization of American States called an Inter-American Conference on the Conservation of Renewable Resources; the meeting was held during October 1965 in Mar del Plata, Argentina. The Ecuadorian Delegation before the OAS took an active part in the Conference's planning and suggested that the program include topics on renewable resource conservation, legislation, and the establishment of educational systems to promote public understanding.

Such efforts to improve conservation education are being aided by the United Nations Development Fund and the Food and Agriculture Organization; these organizations are cooperating in training renewable resource specialists at the Luciano Andrade Marin Forestry Center; conservation and ecology are emphasized in the curriculum. The graduates of this school have been offered jobs all over the continent.

In 1966 the World Wildlife Fund sent a Swiss ecologist, Dr. Paul Schauenberg, to assist the Ecuadorian Government in planning its national park system. In addition to the Galapagos National Park, the mountain peaks of mainland Ecuador over 4,500 meters have been declared protected public domain. Ecuador is also proposing to create a national park along the Equator. This park would preserve an unusually diverse series of life zones across and on both sides of the Andes.

A fellowship provided by Argentina enabled Ing. Pablo Rosero, the Chief Forester in Ecuador, to attend the November 1966 International Course on National Parks and Conservation of Renewable Natural Resources held in Argentina. The interchange among participants resulted in many promises of coöperation. For example, the Peruvian government has offered to help reëstablish a small native camel, the vicuña, in Ecuador.

Unfortunately, many of the excellent programs and achievements of Ecuadorian conservationists usually receive little publicity—particularly in the United States and Europe; even in Ecuador one branch of the government is not always aware of what other sections are doing. To a large extent, this occasional communications failure is compensated for by a relative constancy in governmental resource policy. Most resource programs, and the technicians who are responsible for them, are rarely affected by changes in political administration.

Obviously all governmental action is doomed to failure if it does not have the support and understanding of a large group of informed and politically effective citizens. Such support is particularly vital to effective natural area preservation efforts. Cristobal Bonifaz Jijon, formerly Ecuadorian Ambassador to France, is very much aware of the possible role of private conservation organizations in his country. He recognizes that national parks alone are not enough to assure a comprehensive network of preserved natural areas. In order to stimulate private involvement in natural area preservation, Bonifaz decided to set up a private, non-profit institution modeled after the Nature Conservancy of the United States. He selected as members of his conservancy committee representatives familiar with each of the seven major ecosystems in Ecuador. The Ecuadorian conservancy is now undertaking a series of local projects that will protect and preserve important natural areas in each of these ecosystem types.

Governmental departments, schools, and private organizations dealing with conservation in Ecuador will continue to need well-coördinated international assistance, particularly in inventories, education, and training. An excellent example of such support is the "Survey for the Development of the Guayas River Basin of Ecuador" prepared in 1964 by the Natural Resources Unit of the Pan American Union's Department of Economic Affairs. The survey included an inventory and evaluation of available information on the basin's resources—both human and natural. Ecological factors limiting actual and potential development were stressed in the study. More aid to conservation education and further training of the country's own renewable resources specialists, particularly in ecology, are probably the most important factors that will effectively contribute to Ecuador's ability to help herself.

Conclusion

The evolution of conservation attitudes in Ecuador has been greatly affected by contact with new concepts of man's place within nature; the United States has exported many ideas that have had profound effect upon countries of the developing world: George Perkins Marsh told of the grave dangers inherent in man's uncontrolled exploitation of natural resources for purely economic and political ends; Gifford Pinchot conceived of multiple-use management; American ecologists emphasized "sustained-yield;" national parks and wilderness preservation were put forward by Thoreau, Muir, and Mather; Aldo Leopold urged a land ethic. None of these notions originated in America, but they found fruition here and are re-dispersing throughout the world to take on new forms in new environments and cultures.

And yet, with other industrially developed areas, North America has also exported on a massive scale the most environmentally destructive forms of technology the world has ever known. We continue to send biocides and bulldozers, air bases and industrial pollutants, to countries already saddled with their own severe problems of environmental deterioration. If anything, this article is a plea for restraint. Those who help should learn to curb this many-headed hydra we call foreign aid and be more concerned with providing in advanced countries a landscape un-

fragmented by land-use schizophrenia—a landscape that can serve as a successful example to other nations grappling with the bitter fruits of an overly mechanized society.

Like it or not, the United States, Europe, and other parts of the "highly-developed" world will go on contributing to cultural and ecological chaos in less developed areas little able to resist. The grim exports of a hedonistic, technology-dominated culture will continue. For this reason, conservation—developed in the western world as an environmental antidote to an overdose of technology—must take up the challenge of actively furthering its aims in the developing countries. We hope that the Sierra Club, Conservation Foundation, Nature Conservancy, and other conservation groups of the United States will concern themselves more deeply with their environmental responsibilities abroad. If they do not, much of the world's wilderness heritage will go by default. G. M. Trevelyan articulated well the threat men now face: "... natural beauty is the ultimate spiritual appeal of the universe, of nature, or of the God of nature, to their nursling man. . . . Science and machinery have now armed man with weapons that will be his making or undoing, as he chooses to use them."

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His interest in birds led to Dr. Porter's interest in photography, which, in turn, led to the creation of some of the most beautiful books ever published. "In Wildness Is the Preservation of the World" *is one; another is* Summer Island, *of which the following is a chapter.*

Voices of Spring

ELIOT PORTER

IN THE MINDS of most people, spring is associated with flowers and birds. Robins and some of the hardier birds appear early, when snow is still on the ground but brown earth and last year's withered grass is beginning to show in patches. The gurgling, tinkling sounds of water from melting snow and ice can be heard as the clucking of a robin and his first song uplifts the spirit. But these sounds are merely harbingers of a spring that still is far away. Winter will lash back again out of the north, bringing snow and freezing weather. And the birds will sit with feathers fluffed up to endure the cold, disconsolate and waiting for a change, wondering, perhaps, what had happened to the spring and why they had come so soon. But spring will advance nonetheless, silently and unnoticed. These rearguard actions of winter will be repulsed in the end; the higher sun will assert its dominance through the longer days, and the winds will dry the fallow land wherein a million shoots from the seeds of last year's growth are slowly stirring.

The first flower that breaks into bloom in the snow-covered northern woods is arbutus, its pink and fragrant flowers clustered about with the still-green last-summer's leaves. Then the shad blooms before the leaves have broken their buds, looming ghostlike through the gray forest's trunks. At the same time, red maple buds deliver their petalless flowers to fall and strew the black forest puddles with spidery dots of red. But there are few maples on the Island, so white birches take their place and are the first to be brushed with green. The hillsides and bogs, where white birch trunks stand above the gray-stemmed alder thickets, become feathery with pale new leaves before the catkins appear. This phenomenon of the rising sap can be duplicated on a thawing winter day, I am told by Rupert Howard, if one sets a match to the shredded papery bark of a white birch. The flame will leap up the trunk, briefly warming the whole tree before burning out; and the next day, if the thaw continues, all the buds will open and put forth new leaves. The death of the tree, however, is assured, for its cycle has been upset and its spring has come too soon. Sometimes cycles are upset by natural causes: I have seen a yucca in the west bloom in September and a horse chestnut bloom in October in New England.

An alteration of normal cycle can be induced by other kinds of interference. Once I raised several generations of Polyphemus moths from cocoons, but during the spring and early summer of the second generation I had to be away. To keep the moths from emerging in my absence, I left the cocoons in an icebox until my return in July. Two weeks later the moths hatched normally, mated, and the females laid eggs. It was so late in the season, however, that the caterpillars had insufficient time to develop at their normal pace. When September was well advanced, they still were not fully grown, and the oak leaves on which they fed were beginning to turn brown. I was forced to search far and wide for still-green leaves. Some constituent necessary for continued growth must have been lacking in those old leaves, because the caterpillars stopped eating while still undersized and one by one spun miniature cocoons. The next spring miniature moths emerged, stunted by an inadequate diet and by my disturbance of their normal growing cycle.

When the month of May is well advanced, a New Englander may look for the arrival of the first great wave of migrating birds. It is an event of considerable consequence and involves in its most spectacular aspect that colorful family of new-world birds, the wood warblers. As the leaves unfurl, the vanguard of the later-migrating hordes begins to arrive, a few early warblers and many sparrows of different species. The casual observer of the spring realizes that birds are singing again. He will say, "I heard a song sparrow today"; or "What was that new song I heard this morning for the first time?" But to those for whom birds are a hobby or a profession these events will long have been noted. These people are out early with their binoculars to identify every new arrival by sight and by song. They have also been waiting for a certain morning, that morning on which the trees are suddenly alive with birds, all busily foraging for insects that have appeared with the first leaves. Through the short moonlit night the new arrivals have flown. They are hungry after their exertions and must renew their bodies for the next lap of the journey north. Were it not for the food they find during their daytime pauses they would not continue their flight, and would

perish from starvation. The next year their numbers would be less, and after that, if the shortage of food continued, there would be silence in the spring.

In incredible thousands, birds occupy every tree, fluttering from branch to branch in a feverish search for insects. Warblers by far outnumber all other birds. The first waves are the males, identifiable by their gay plumage and their songs. All day long on the Island, and day after day for several weeks, I have watched them, sought them out, and determined their kind. They come in all colors: orange, yellow, brown, greenish hues, blue, and occasionally red. Of the many combinations and patterns, blue and yellow predominate in myrtles, magnolias, Canadas, and parulas. With few exceptions though, they all are marked with some yellow, which varies from the total yellow of summer warbler to the crown, rump, and small yellow flank-spots of the myrtle. The songs, too, seem infinitely varied. Some, high-pitched and buzzy, are near the limits of hearing, like those of the blackpoll and bay-breasted; others are rich and melodious, like the yellow warbler's or the throaty song of the Canada. And in between these extremes—a multitude of other songs.

At dawn the chorus begins. I awake early, and from my bed listen to the announcement of spring and count the number of songs I can hear. Some, right outside the window, are loud and insistent. A black-throated green warbler is trying to get me out of bed with his strident, simple notes, and farther away another is singing a different version of the same theme. Faintly, in the distance, I hear a magnolia, and can also make out the sibilant buzz of a parula and the weaker, warbly song of the myrtle. Then nearer again I hear several redstarts. But behind and through all these separate songs a constant chirping, peeping, and rustling forms a background of indistinguishable sounds that attest to the thousands of night arrivals. Since the waves of birds began—for several mornings now—I have been hearing new songs at the start of each day. I identify some old friends who have returned for the summer; and I recognize, too, the songs of Blackburnians and Cape Mays, birds who pause at the Island only for a rest and are gone with the night in a day or two. Warblers are not all I hear, however, for mixed with their songs are those of red-eyed vireos, whitethroats, purple finches, wood pewees, crossbills, and the cheerful, ebullient ruby-crowned kinglet. I am unable to lie in bed, for I must see as well as hear the throngs that have taken possession of the Island during the night. Once out, I find it hard to concentrate on any particular bird. Everywhere, in all the trees, especially among the tender new leaves of the birches, is a seething mass of active, brilliantly-feathered little bodies. My eye is caught by a flash of orange and black, and my subconscious automatically registers "redstart," but my mind cautions, "Are you sure it is not a Blackburnian?" As I hastily try to bring the creature into the field of my binoculars I catch a glimpse of a black necklace about the yellow throat of another bird. I switch to him to make sure I saw a magnolia and not a Canada, and now the orange one is gone. In desperation, I lower my glasses and stare at the tree, not knowing where to look next and not really caring because I know they are all there; I have heard their songs. Sooner or later it is certain each kind will pop into view, and unless I hear a strange song my eyes would only confirm what I already know. Nevertheless, for a long time I wander, hungry for breakfast, but unwilling to return to the house, unwilling to disengage myself from this wondrous phenomenon of life that recurs each year.

From the jungles of South America, over thousands of miles, these tiny birds wing their northward way, undaunted by the hazards of ocean wastes, or the wastes of civilization. Instinct impels them to reproduce their kind in their ancestral lands. To what is this annual two-way mass movement a response? Perhaps it is an adaption to the advent of the ice age scores of thousands of years ago. But think of the casualties there must have been in those past eras; how few must have survived the year-long winters of snow. And from those that escaped have evolved the present families and species. Every year since the retreat of the ice these growing families have returned to their old homes, and by so doing have given to their kind the scope to multiply freely, away from the overcrowded tropics. Perhaps somewhere buried in the depth of their brains there has survived through these ages an ancient memory, an intense, vital spark, a pattern of cells that initiates and controls their return. Here they all were, returning by the billions, like waves beating against the retreating winter, now only a symbol of the ice that covered this land not so long ago. They occupied every available island, gathered in unusual concentrations along the coast, and spread over the whole breadth of New England. Every wood, hill, and farm was this day ringing with the songs of these uncountable numbers of birds. This is indeed the mystery and miracle of spring.

What is the value of preserving and strengthening this sense of awe and wonder, this recognition of something beyond the boundaries of human existence? . . . Those who contemplate the beauty of the earth find reserves of strength that will endure as long as life lasts. There is symbolic as well as actual beauty in the migration of the birds, the ebb and flow of the tides, the folded bud ready for the spring. There is something infinitely healing in the repeated refrains of nature —the assurance that dawn comes after night, and spring after winter.

—Rachel Carson

Toward an Earth International Park

THE EARTH that man has already touched—sometimes gently and sometimes brutally—can sustain his advancing civilization if he applies his science, his technology, and his genius to the challenge of going back over what he has touched and ameliorating his mistakes. Hardly a tenth of that earth is still essentially uninterrupted by his technology. This is the wilderness, the miracle that man can tear apart but that he cannot reassemble. This vestige is all that all men will ever have here. It contains answers to questions man has not yet learned how to ask.

Wilderness is no longer extensive enough to protect itself. Man must now protect it from himself. He must supply the sense, the hearing, the taste, the smell, the touch, the seeing, making sure that he does not blindly oppose progress but that he never lets blind progress go unopposed. What progress seems to have achieved is so spectacular that it preëmpts our attention; it lets us forget the most important element of all—the life force, the unbroken link to the beginning of life on earth, that from the long-ago beginning on down to each of us has never failed to reproduce itself well and move on. That force, in two billion years, has also produced a miraculous complexity of living things, each more dependent upon the others than we know. It has produced organic wholeness, and Robinson Jeffers would have us "love that, not man apart from that."

But we are taking that organic wholeness apart, tinkering with it and losing the parts, simplifying it without asking how dangerous it may be to do so. Compulsively we take a natural piece of land, with all the species that magically convene on the surface we see, rising out of all the life forms we cannot see or know below the surface, and we order this miracle to reduce itself to a single crop of cotton or tobacco or Douglas fir, a monoculture. Instead of respecting the natural succession, we simplify it all. We already suffer from infectious monoculturosis. As we extinguish more and more wild things, we are draining the genetic pool. With no little arrogance, we take it upon ourselves to steady the omnipotent force throughout the land, even to the last wilderness.

Assuming that GNP>DNA, we have turned our technology loose and have already done more to disrupt natural things in our own lifetimes than were disrupted in all previous history. Our generation is also speedily using up, beyond recall, a very important right that belongs to future generations—the right to have wildness in their civilization, even as we have it in ours; the right to find solitude somewhere; the right to see, and enjoy and be inspired and renewed, somewhere, by those places that have not been obscured by the industry of man.

Man is prolific enough to explode across the land, but he can only do so at the expense of the organic diversity essential to the only world he can live upon. When deer populations explode, the deer overload their range, lose vitality, and starve. Mankind has a range, too, and it has a maximum carrying capacity consistent with a good life—a life with enough resources on hand to serve a restrained population and to spare nations from the final quarrel over them. We may argue about the capacity but we know there is a limit. We have strong intimations, as we watch the sea of smog rise around us, that the limit is approaching faster than we thought, and from a different quarter. We can see that growth without end will be monstrous, then malignant, and finally lethal, and that economy based upon incessant growth is a chainletter economy, in which we pick up the handsome early returns and our children find the mailbox empty.

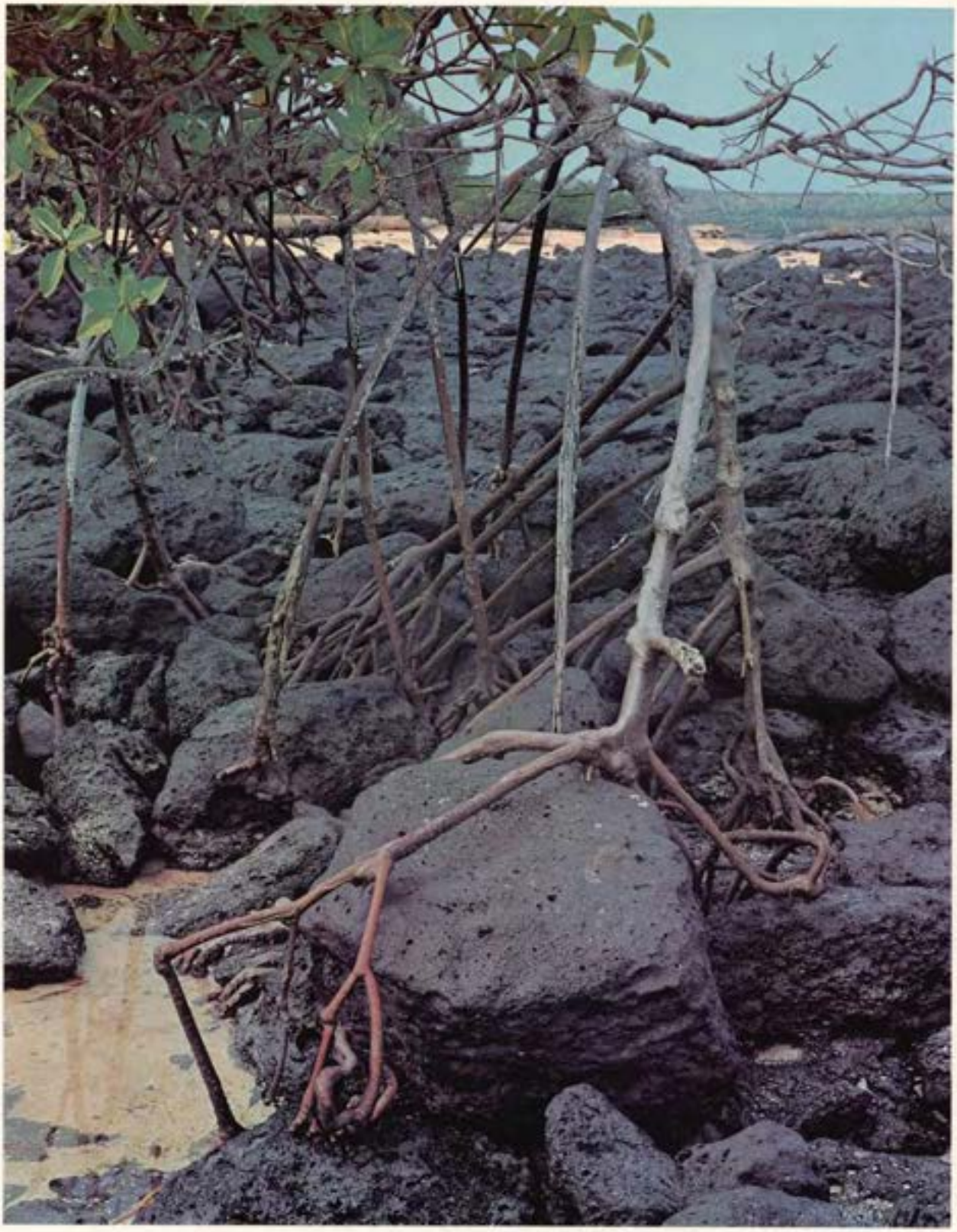
How boldly can we revise our thinking? How big is our plan to survive our own cleverness? How creative can the genius in each of us be—the genius that is the crucial resource—in our learning not to live alone but to grant other life forms the right to coexist? What will happen if our denaturalization goes on into the future, this same urge to grow and doublegrow, ever multiplying what man imposes upon this planet and forever dividing what God put there?

I think we know, now, and that we will oppose the growth that masquerades as progress. Knowing that predictions tend to be self-fulfilling, we can start predicting a desirable future, not a horrible one.

The genetic pool, the organic diversity, the earth's thin, miraculous essential epithelium—these are what man has heretofore hastened to dissolve, to poison, or to inundate with smog, reservoirs, and pavement. The tithe of the earth's surface we like to think of as wilderness is no longer unsullied. When we discover DDT in the fatty tissue of penguins in the Antarctic we know we put it there. Man has so disrupted the natural forces of succession everywhere that a forester recently advocated that we should now turn to synthesizing ecosystems of our choosing, inasmuch as there is no true wilderness left. His audience of students liked a question from the floor: "Because the lady has slipped once, must she go professional?"

To steady her, perhaps, Mr. Jerry Mander, the man who writes most of the Sierra Club ads, has suggested that there should be an Earth International Park, to protect on this planet what man has not destroyed, what he cannot replace, and what need not be destroyed if he uses his genius well. In this action, all the nations could unite against the one real common enemy—Rampaging Technology. Here might be rescued instead, for the improved men we should hope will be born here in centuries and millenia to come, the natural places where answers can be sought to questions man has not yet been wise enough to ask.

— D. B.



ELIOT PORTER: Mangrove roots, Santa Cruz Island

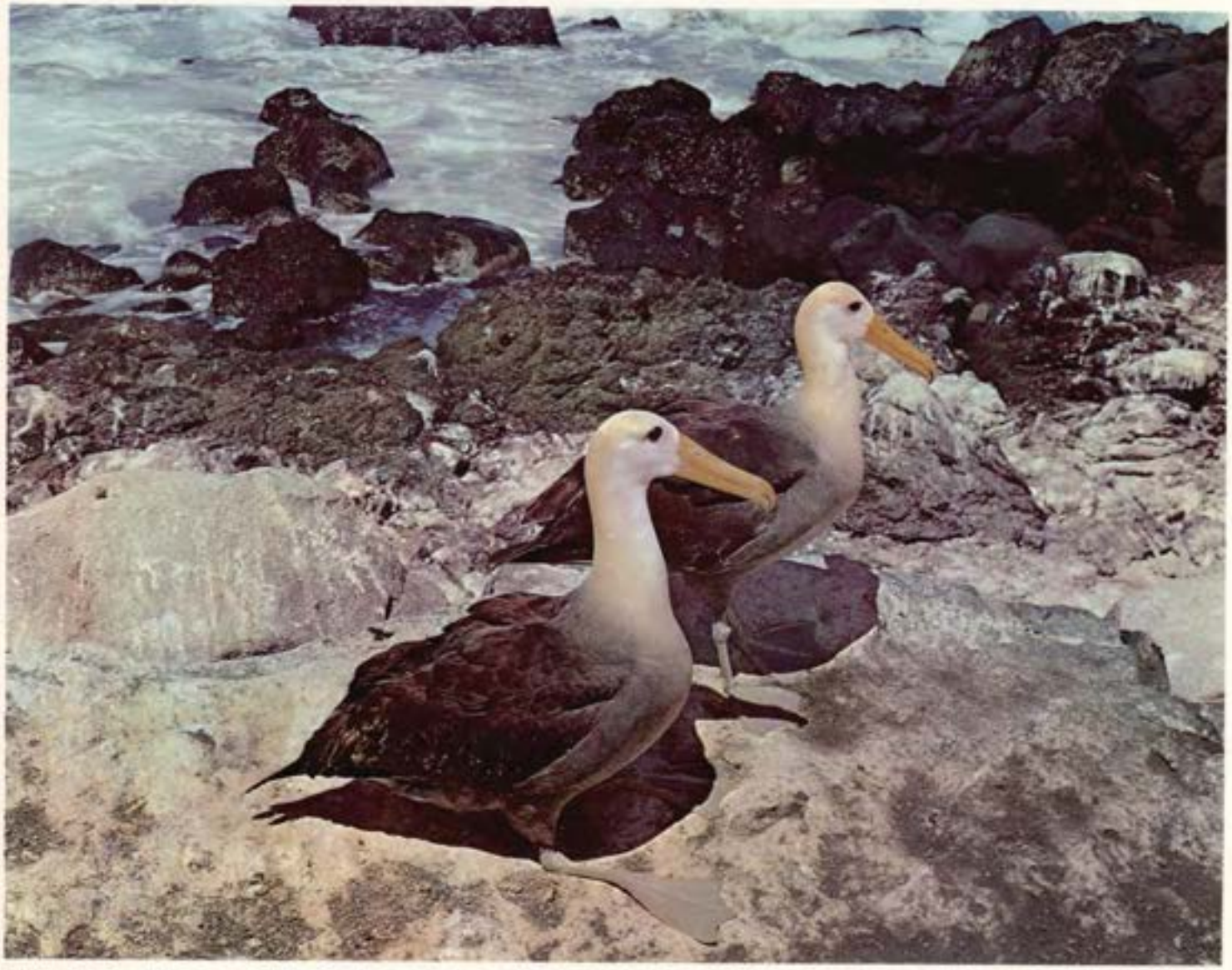
Galapagos

When we try to pick out anything by itself, we find it hitched to everything else in the universe.

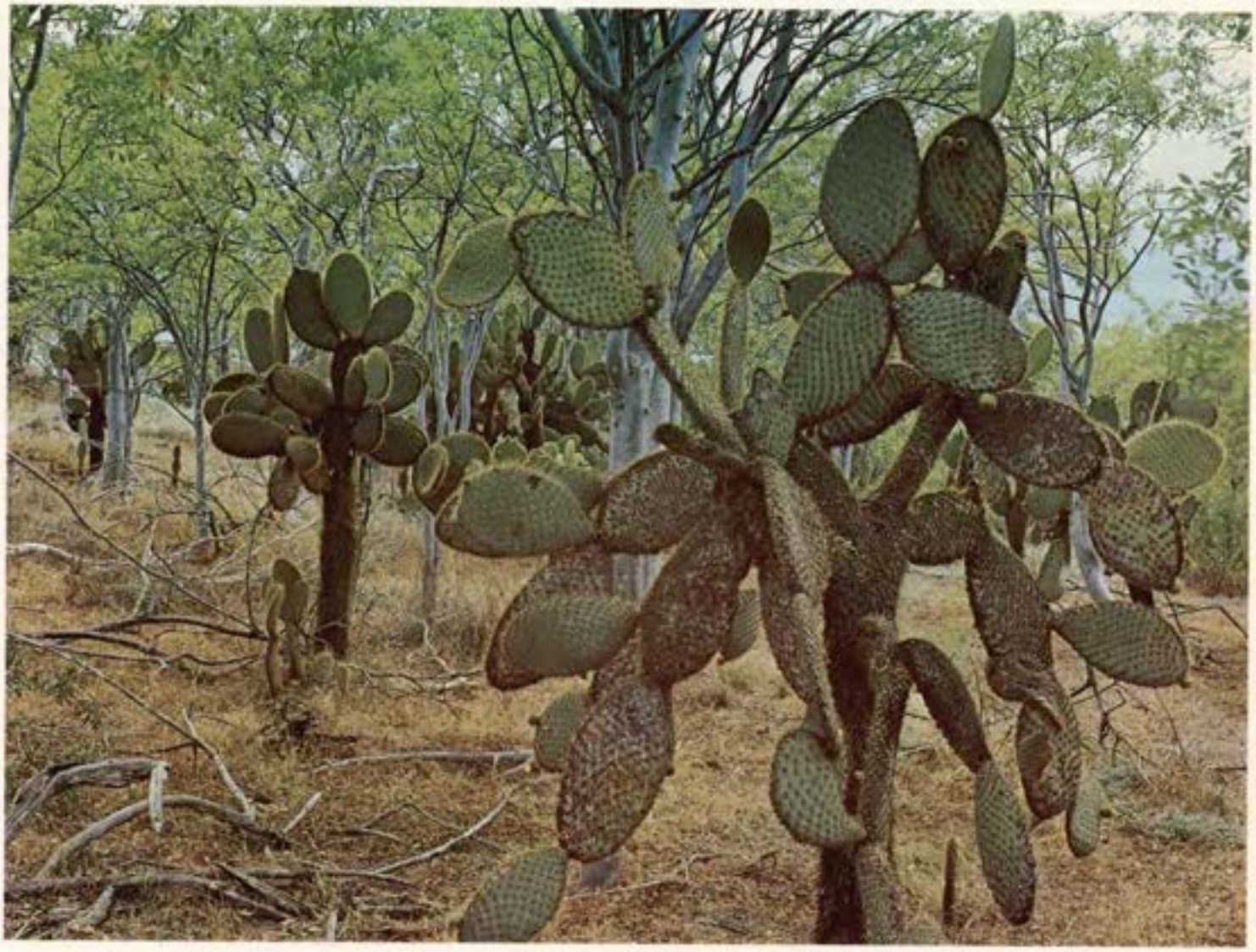
—JOHN MUIR

. . . Integrity is wholeness,
the greatest beauty is
Organic wholeness, the wholeness of life and things, the divine beauty
of the universe. Love that, not man
Apart from that, or else you will share man's pitiful confusions,
or drown in despair when his days darken.

—Robinson Jeffers



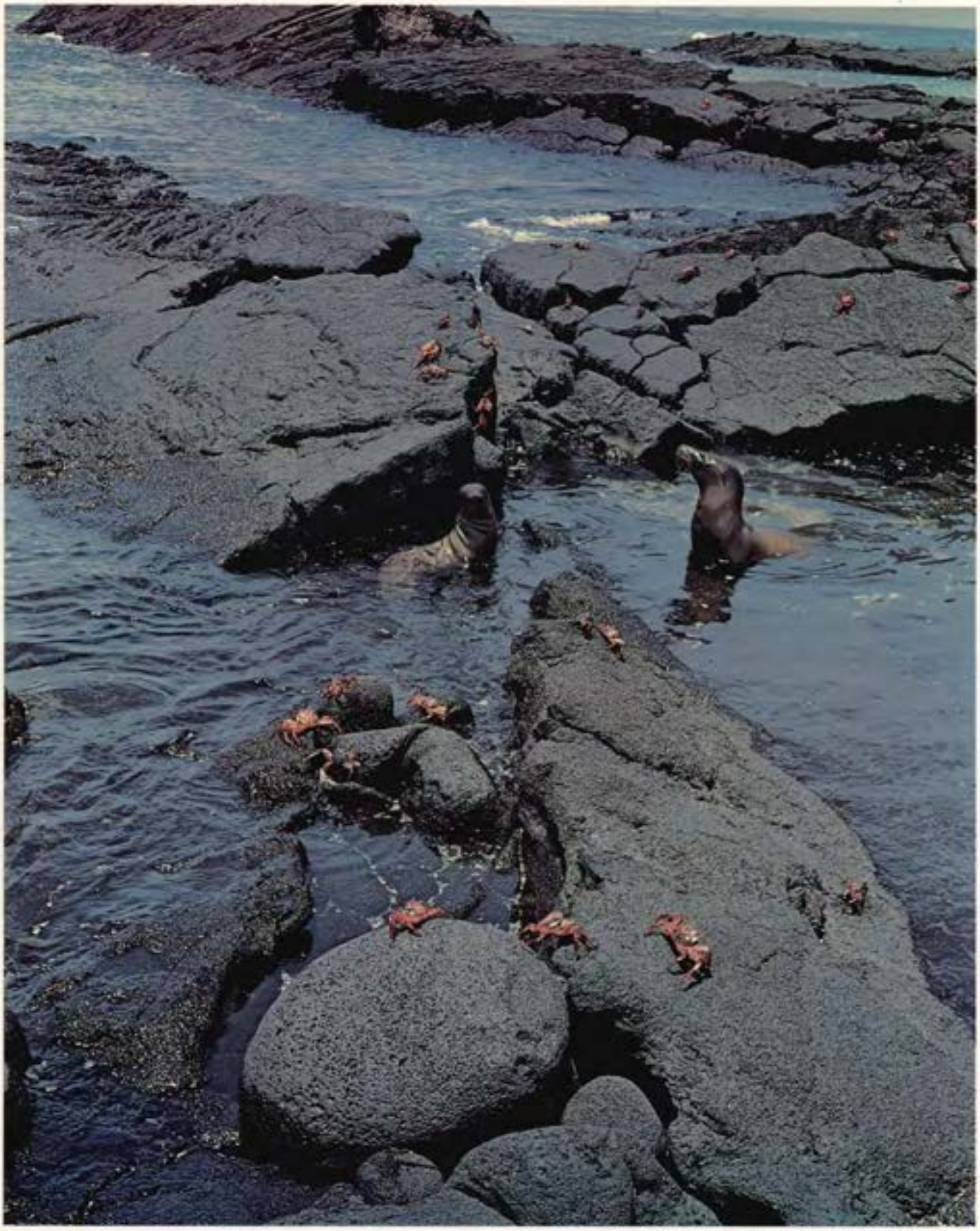
ELIOT PORTER: Galapagos albatrosses, Hood Island



ELIOT PORTER: Tree cactus, Cartago Bay, Isabella Island

The need is not really for more brains,
the need is now for a gentler, a more tolerant people
than those who won for us
against the ice, the tiger, and the bear.

—Loren Eiseley



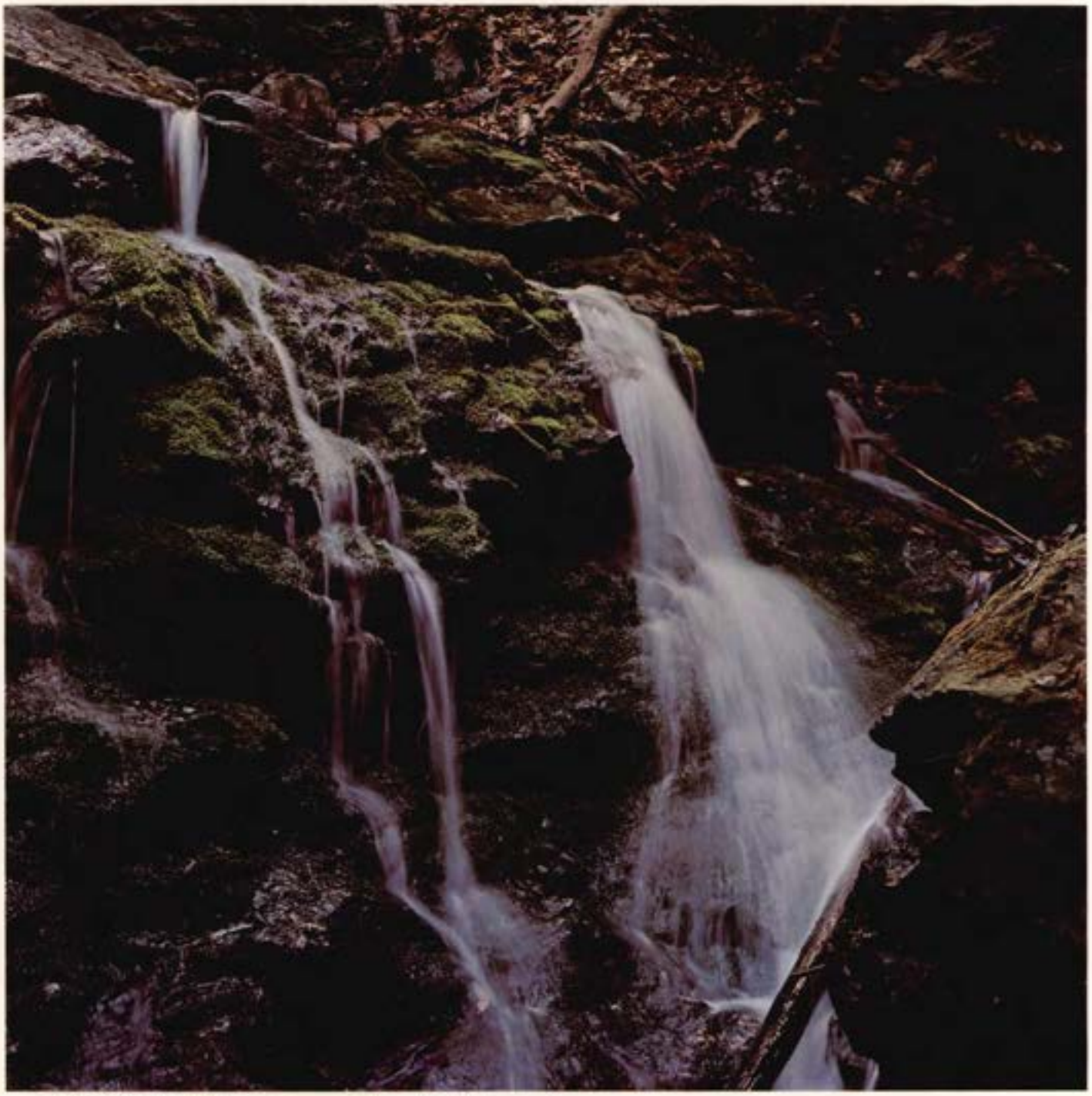
ELIOT PORTER: High tide at Point Espinosa

In wildness is the preservation of the world.

—Henry David Thoreau

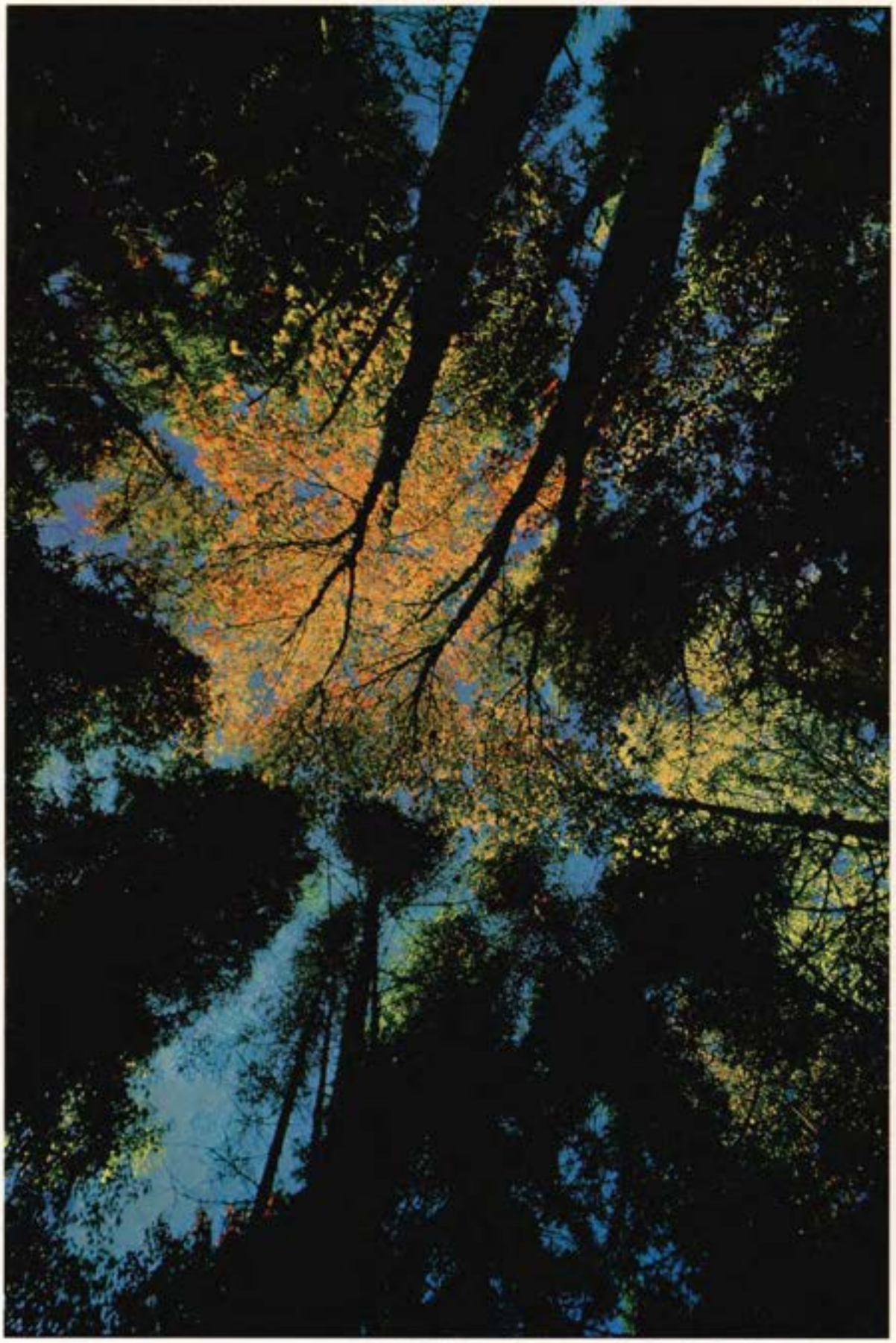
ELIOT PORTER: Boogums blooming near Mission Calamajué, Baja California

We travel together, passengers on a little space ship . . .

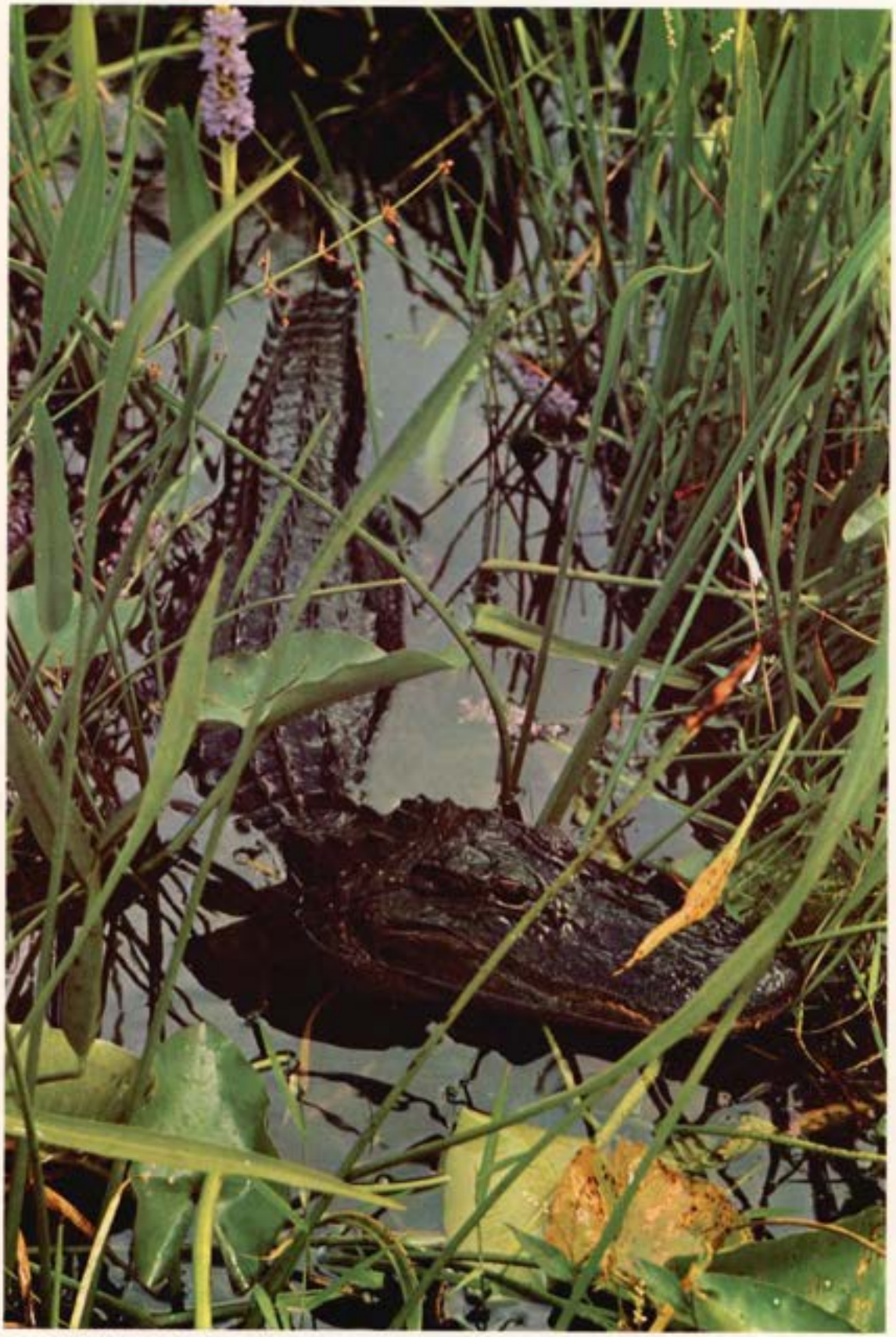


LAURENCE PRINGLE: Impoundment area of Storm King hydroelectric project

. . . dependent on its vulnerable reserves of air and soil; . . .

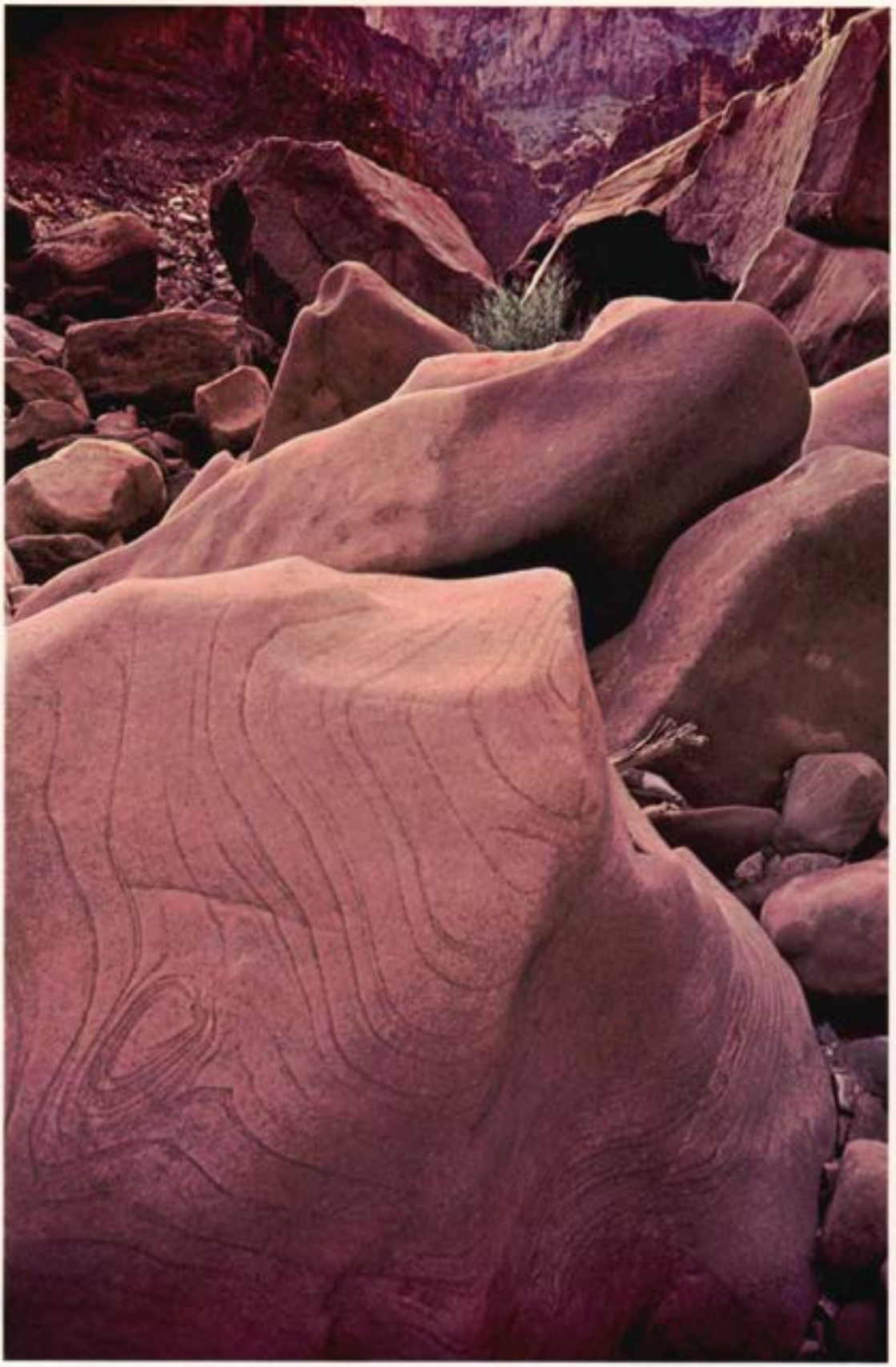


CHARLES STEINHACKER: Autumn sky along the Allagash River, Maine



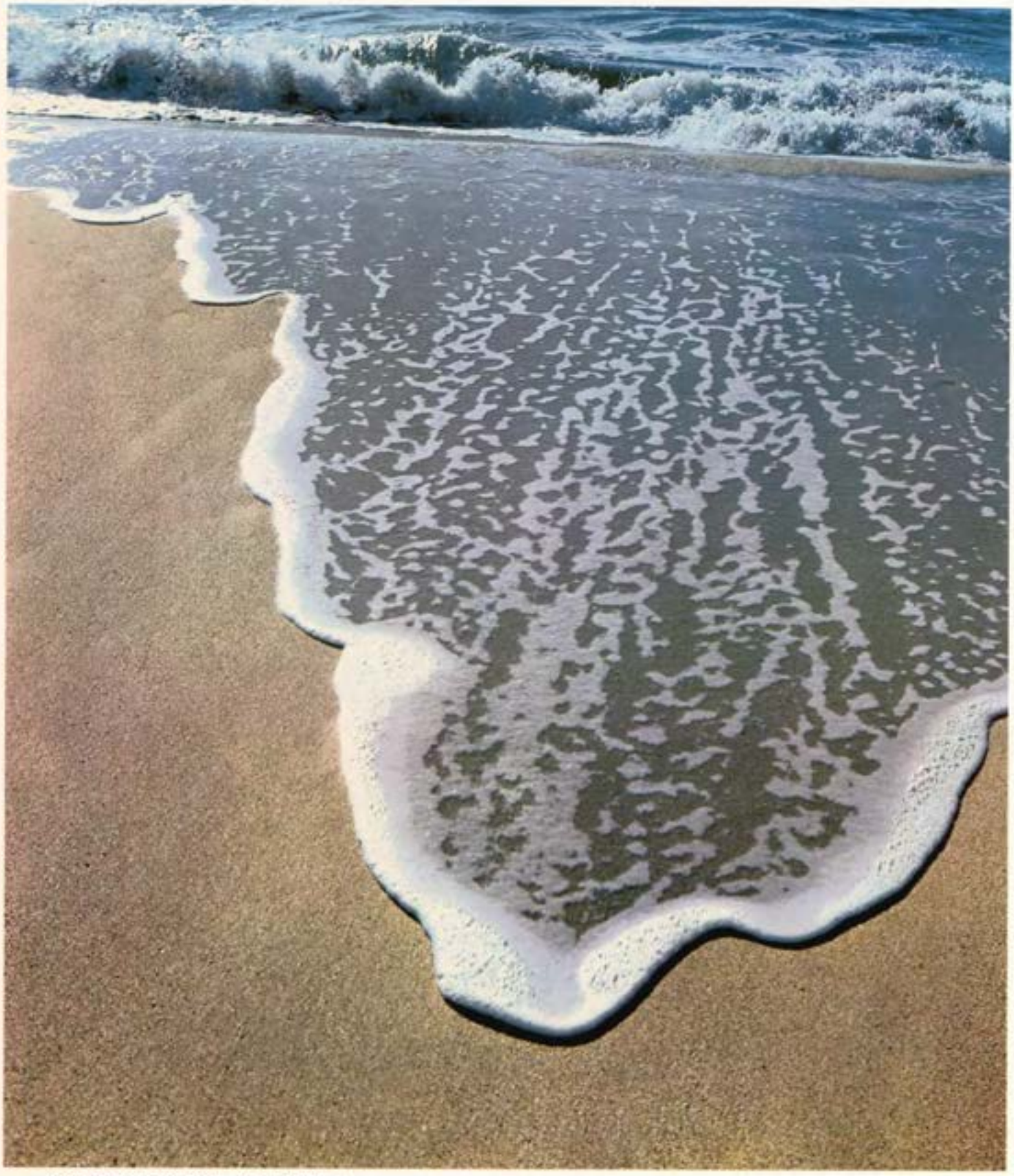
PATRICIA CAULFIELD: Alligator, the Everglades

. . . all committed for our safety



ERNEST BRAUN: Grand Canyon

to its security and peace; . . .



ROBERT WENKAM: Barking Sands Beach, Kauai

PHILIP HYDE: Monument Valley from Muley Point, Utah

. . . preserved from annihilation only by the care, the work and, I will say, the love we give our fragile craft.

—Adlai Stevenson

BARRY BISHOP: Unsoeld and Hornbein approaching the West Ridge, Everest

. . . Until one is committed there is hesitancy,
the chance to draw back, always ineffectiveness.
Concerning all acts of initiative (and creation),
there is one elementary truth, the ignorance of which
kills countless ideas and splendid plans:
that the moment one definitely commits oneself,
then Providence moves too.
All sorts of things occur to help one
that would never otherwise have occurred.
A whole stream of events issues from the decision,
raising in one's favor all manner of unforeseen incidents
and meetings and material assistance,
which no man could have dreamt would have come his way.
I have learned a deep respect
for one of Goethe's couplets:

Whatever you can do, or dream you can, begin it.
Boldness has genius, power, and magic in it.

—W. H. Murray

In a symposium on systematic biology and natural areas, an Associate Professor of Botany at the University of Wisconsin challenged his colleagues in the biological sciences to assume a role of leadership in the conservation movement

Whose Fight Is the Fight for Nature?

HUGH H. ILTIS

IT IS A VERY GREAT PLEASURE to be here tonight, because Washington University and the Missouri Botanical Garden are my old student stamping grounds. As the blackest sheep of the class of 1952, being asked back to the scene of my crimes, and furthermore, being furnished with such a fine captive audience of eager taxonomists and ecologists, is a delightful twist of fate.

It is an honor to be here also, and for deeper reasons. My schooling here, excellent as it was, included hardly a word about conservation. Surely, we had the use of Dr. Anderson's barn at the Missouri Botanical Garden Arboretum, far out in Gray Summit on the Ozark plateau, to study ecology, to listen to "Andy's" inspired teachings of man's disruptive effects on natural habitats and the consequent introgressive hybridization in many groups of plants, and to go hiking, camping, and courting. But academic biology in those days was untouched by arguments about nature preservation, and unless a student here happened to overhear an A. J. Sharp or a Julian Steyermark, he might have gone through graduate school without knowing that there was indeed a very serious problem. After all, in 1950 the weekly net population increase in the world was only 700,000 individuals. Today, in 1966, it is around 1,300,000! And by 1980, only 13 fateful years away, it will be close to 2,000,000 individuals per week—each week, two million additional souls will see the light of day, will need food and space, will forcefully bend nature to their human needs, and will exterminate countless species of plants and animals with a ferocity that only the human species is capable of. It is surely clear to all but the blindest of evolutionary optimists that the biological problems of both nature and human existence are now much more acute, and are becoming increasingly urgent each day.

Thus, the sponsorship by the Missouri Botanical Garden of a Symposium on Systematics and Natural Areas, and your enthusiastic response here, is hopefully a belated reflection that we botanists finally are willing to work and fight and sacrifice for the survival of a diverse living world, for the plants with which we work, for the biotic environment in which we live. To assume some of the minimal social responsibilities that our specialized knowledge in taxonomy and ecology has given us, a responsibility which most of us and our predecessors have so long evaded, will dignify our endeavors with much meaning.

Nature preservation in Wisconsin is my assigned topic, and I will tell you later about the various approaches that we successfully tried, and what you and I can and must do through our own work and initiative, wherever we may be.

Yet, it may be well to speak first about some of the implicit reasons for nature preservation in the world. These fundamentals are but rarely discussed. Though they include the most basic of motivations ever to slumber in the hearts of men, they have been either ignored or ridiculed sometimes even by scientists who should know better. Yet, their proper appreciation will not only vitalize our own efforts, but might well provide a powerful platform for rallying the much-needed, indispensible public support without which all conservation is bound to fail. I speak of a platform based on the understanding of human evolution and its meaning to conservation. It is here that the best arguments against blind technological progress may be found, it is here that biologists can find a logic to support their inherent love for nature.

The Promise of Technology —A Deceptive Heaven

We have spent a whole day discussing how we taxonomists can use natural areas in teaching and in research. That these practical matters need airing is obvious. But let me raise some further personal questions about our profession and the way we use our knowledge.

What is the taxonomist's relationship to society? What is his role in conservation? Why should we biologists in particular expend our energy and show our concern? Why

should we, why must we, as taxonomists, provide leadership in conservation?

Technology has promised us a post-evolutionary heaven in which wild nature has a very minor role. Molecular biology, too, has gleeful visions of genetic manipulations of DNA which would change the face of all creation and recast man into a "perfect" image. Others dream about a cheerful if dull world with unlimited opportunity for at least 40 billion people, as a recent conservation issue of *Soviet Life* pointed out in all seriousness. But any one of us, if not blind, who has hunted for prairie flowers in Illinois, or gone exploring in the Peruvian Andes or on the Mexican Plateau, or tried to find a tree growing in Brooklyn, knows that life's diversity is threatened with imminent destruction, that it will be all but over in 20 or 30 years for this exuberant biotic wealth. The crisis for all the living is here and now. The world of the future promises to be flower-less, animal-less, and lifeless, except for masses of people. In the next century, in nightmare worlds of steel and concrete, of algae steaks and yeast pies, the day may well come when our great-grandchildren will hold hands in a circle and sing: "Spring has sprung, The grass has ris, I wonder where the flowers is"—and wish they could see one.

Is there any one among us who would like to live in such a world? Is there any one among us who would not agree that, to remain human, man needs a good helping of wild nature to walk in, to cherish, to love? Indeed, we all love flowers and birds, and seemingly must, through some inner unexplained urge, go exploring for plants and find wild nature, even if it is in a botanical garden. But is it enough to say that "we need"—that " we love"? The sceptics want to know "why?" and the despoilers of nature, the technicians of exploitation or the technicians of use, are not impressed by sentiment, but by dollars and profit, board feet and yield per acre. How can we biologists defend sanctuaries for prairie flowers and "song" birds and mountain lions and pitcher plants? How can we defend such luxury when our world is plagued with hunger? Can we defend it for reasons other than scientific use? For reasons other than commercial return? Can we defend, in short, a truly human environment for purely selfish human reasons?

Man in Nature
As a Genetic Relationship

Let us try to define a human environment, one in which mankind can find maximal fulfillment. Might we not say the best human environment is one in which the human animal can have maximum contact with the natural environment in which it evolved and for which it is genetically programmed without sacrificing the many advantages of civilization; that is, the optimum modern human environment must represent a compromise between our genetic heritage, which we cannot deny, and the fruits of civilization, which we are loath to give up.

Physically, as any evolved animal of the tropics, we are fundamentally adapted to wild tropical or subtropical nature, but culturally, especially away from the equatorial regions, we are dependent on and culturally adapted to towns and cities. Thus, even though we live in houses for our physical well-being, nature must be thought of as an indispensable biological need in our daily life. Every basic adaptation of the human body, be it the ear, the eye, the brain, yes, even of our psyche—demands for proper functioning an environment at least similar to the one in which these structures evolved through natural selection over the past 100 million or so years. For millions of generations, as George Gaylord Simpson points out, any of our monkey ancestors with faulty vision who missed the branches they jumped for fell to the ground, and failed to become our ancestors. Only those that were adapted to nature contributed to our gene pool.

We, who are Darwin's grandchildren, can thus easily appreciate that like the need for love, the need for nature, the need for its diversity and beauty, has a genetic basis. We cannot exclude nature from our lives because we cannot change our genes. That must be why we citified and clothed apes continually bring nature and its diversity and its beauty into our civilized lives, yet without really understanding why we do. We have flower pots and pedigreed pets, members of the "Plasticales" in every bank, and even airplane "puke bags" with green beech leaves imprinted on the side to make us feel better, to alleviate boredom or sickness by catering to our genetically based appreciation of natural beauty.

In contrast, spend a week in the heart of downtown metropolis, with all its noise, stench, and congestion. No "natural" selection equipped us humans for such insults to the senses, except that in the past 20,000 years we have probably degenerated: in comparison to our ancestors we have poorer powers of sight and smell, less sensitive ears, and much less hair. Someday, if we are not careful, through city-selected degeneration, the 40 billion of half-deaf, half-blind *Homo post-sapiens* will lead a life resembling that of termites. Then, even if high quality natural environments still survive someplace by accident, our descendents may well not be able to appreciate any of it.

This is not what we should want! Yet the beginnings are here at our very doorsteps. Is not the initial wreckage of such selection already crowding our mental hospitals? And, interestingly enough, in the last ten years several states have tried group camping with the mentally ill, using contact with the out-of-doors as psychotherapy. During the past four years, for example, the Maryland Department of Mental Hygiene under Maxwell Weismann took 90 chronically ill patients from the State Hospitals to a summer camp for two weeks of standard camp activities. The patients, 40 to 60 years old, had been hospitalized from two to 30 years. In the camp, even in severe cases, unanticipated changes were taking place in the patients. Some schizophrenics spoke for the first time in five years! Perhaps because flowers do not talk back! Perhaps because of innate needs for unfenced freedom. (The first words uttered by

one patient after years of silence: "This is freedom!"). Significantly for the field botanist, hiking and nature study became the most popular activities outside of eating. On return, 41 out of the 90 patients were able to leave the hospitals within three months. Despite great difficulties, some efforts have now been initiated to buy wild lands for such a camp in Maryland, and hopefully in other states as well. To us, as botanists and conservationists, it should be an encouraging sign, like this meeting, a hopeful rebirth of sanity, a reawakening to the human values of wild land.

Nature in Man As a Cultural Force

I have tried to show that separated from nature the human animal as a biological unit is in most ways a meaningless bundle of adaptations. Similarly, man as a cultural force cannot be understood without his landscape. Today, as never before, there is an overriding urgency to awake in time to prevent the permanent subjugation and extinction of the living landscape, whether wild and free or farmed in a non-intensive way.

Senator Ingalls of Kansas said some 80 years ago, "Give the philosopher a handful of soil, the mean annual temperature and rainfall, and his analysis would enable him to predict with absolute certainty the characteristics of the nation."

We, today, are ignoring this basic truth. We, in this overly rich country, now worship the high standard of living, but forget that ultimately it flows from the land. We credit scientific advances, the pioneer spirit, and democratic institutions with our great agricultural wealth in the Middle West, but often neglect to mention that due to an accident of nature we have some of the richest farm soils in the world.

Until 30 years ago, we identified closely with the pioneers, their hardships and devotion, their environment of hostile Indians and waving grass, of cattle and cowboys. The prairie was their garden in more than one way! The six feet of topsoil, the magnificence of millions of buffalo, the sweat of the breaking of the sod and the harvest of vast yellow fields of wheat are part and parcel of our history. Without the prairie or the forest, we the American people cannot understand where we came from, what we are, or where we are going. Yet today the prairies and the forests have been largely killed, and thousands of species, especially of the prairie flora, are on the verge of extinction. By our avarice, we are losing touch not only with our biology, but with our history and with our culture. Meanwhile, our technological cheerleaders urge us on to more intense utilization and greater destruction, here and in the underdeveloped countries, with the blessings of many a thoughtless scientist who can think only of his specialty and the good safe problems of 30 years ago—and with the unqualified approval of most economists, who can dream only of expanding economies and the stockmarket.

Does all this really matter? Surely, our technology may keep us rich and abundant; but will it keep us human? Will it satisfy the simple and vast unspoken needs of humanity, the need to keep in touch with its ancestry? The need to live a biologically and culturally meaningful life?

The original landscape before the settlers came is still vitally important to our educational process. We need fenceless wild lands to know how our forefathers lived and worked. To understand our very existence, we need wilderness to know where we, the human species, came from. Yet we are rapidly becoming cultural and evolutionary orphans—a people without a past, a species out of context.

Whether we are concerned with such basic biological or cultural considerations, or show concern for preservation because of some immediate or long range economic or ethical concerns, the fundamental relationship of man to nature must be clearly understood. It should never be forgotten that his is the only living world, the only flora and fauna that you and I and our children shall ever have. It should never be forgotten that we are given now our last chance to preserve even bits and pieces of our biotic environment, the last chance to save our flowers, and birds and fish.

The Social Responsibility of Systematic Biology

But whose responsibility is this preservation? Who should take the first step to deflect the technological tide? Some of my scientific friends, the physiologists, tell me that botanists are not, as I charge, irresponsible in their lack of preservational concern, because, they say, this activity is simply not their responsibility! They are scientists, and not conservationists. Preservation, they say, is a public and political or moral problem (which is indeed true) and therefore lies in the province of the politician or the voting citizen. It is, they say, not the scientist's (or specifically, the taxonomist's) job to get involved in preservation as a scientist, but only as a human being.

This, I submit, is a pernicious lie! Chemists, physiologists, agriculturists, in fact most professional biologists generally, don't know an *Astragalus* from a *Zinnia*! And neither do they much care! If they think about this at all, what is a tropical forest but potential lumber, a prairie but a potential cornfield?

If there is anybody who should provide leadership in the preservation movement it is the systematic or environmental biologist, you and me. We are not only citizens and humans, each with individual desires. We are not only trained taxonomists or ecologists, each perhaps wishing to preserve the particular organisms with which we work. But we, the taxonomists and the ecologists, are the only ones in any position to know the kinds, the abundance, and the geography of life. This is a knowledge with vast implications for mankind, and therefore vast responsibilities. When nobody else knows, we do know where the wild and significant areas are, we know what needs to be saved and why, and only we know what is threatened with extinction.

We are responsible precisely because we know, and because we love. When the Amazonian forests or the world's grasslands have all fallen total prey to the gods of economic development and to the devils of human stupidity, no one will care to ask "Who was responsible?" But in fact, we all will have been guilty! Let us then paraphrase the old Talmudic questions: If not us, who shall speak for the flowers? If not now, when?

The Irresponsibility of Biology

And the record of the taxonomist is far from perfect! Many of us are nonsociable, often insecure introverts: timid, apathetic, self-centered, and a bit ashamed about caring what happens to flowers. Perhaps we enter into botany because we *are* peculiar people. "You don't have to be crazy to be a taxonomist, but it sure helps!" Jack Sharp used to say. Edgar Anderson once quipped in provocation "You know what taxonomists are? Taxonomists are mice hiding behind herbarium cases hating each other."

Do we deserve such sarcasm? Yes, indeed! For how do we use our convictions? Where are we botanists when the going gets rough? When our wild lands go on the economic auction block and become the Gross National Product? Where is there a botanical group to protest our Gross National Destruction?

Does the Botanical Society of America, for example, have a committee on conservation? It does not! [As a consequence of A. J. Sharp's thoughtful speech at the 1966 A.I.B.S. meetings, the current president of the B.S.A., Dr. Harold Bold, has appointed, finally, a Conservation Committee. H.H.I.] What about the American Society of Plant Taxonomists? Certainly not! And neither does the International Society of Plant Taxonomy, nor the Society for the Study of Evolution. Shouldn't they at least show their concern? What will we taxonomists and evolutionists study when cows and corn dominate the earth?

Except for the Ecological Society, do we botanists send representatives to the wilderness or pesticide bill hearings? Why, no! Are we such cowards that we cannot even send a letter defending our views? If botany, especially taxonomy, does not get the public's confidence, it is its own fault. For all that Congress and the American people know, botanists don't exist.

The consequence of this apathy is disastrous! For the opposition is always there *in forte*, including lawyers and lobbyists and all the members of academia involved in that gray area of consulting, advising, and vested interests: foresters and cattlemen, bacteriologists and economists, geologists, and entomologists, all have their say.

By default, by indifference, or by coöperation, we *give* almost all the victories to the exploiters, which, superbly organized, have money to burn, talk "common sense" in doctored press releases, and have allies in a vast number of underlings, in and out of universities, in and out of government, who can hardly be expected to bite the hands that feed them. Some day, when it will be far too late for the issues to really matter, the history will be written of the *Silent Spring* controversy of the early 1960's, and of the shameful and cowardly role of much of biology and the blindness of most of agriculture. It will be nothing for us to be proud of.

In most universities' botany courses, we teach about the birds and the bees and DNA, but are indifferent to their human and ecological implications. By our silence, we perpetuate the pernicious falsehood that science has nothing to say about ethical values. We acquiesce to silencing and censorship by university deans, and reap a moral *Silent Spring*. Through collusion or indifference, we biologists are thus losing not only our self-respect but also what could be our strongest ally: a well-informed and aroused public. As a matter of fact, it is the public that, taking the initiative, often forces us to take a stand in the interest of man. It is a strange and sad paradox that most contemporary botanists should require propaganda to persuade them to initiate or even support political measures assuring some survival of biotic communities and, thus, a healthy human environment. Yet so it is.

What about our leaders of the American "Botanical Establishment," the graying heads of the National Academy of Sciences? Surely, in their wisdom, they must see that the living world is falling apart at the seams. Surely, their secure and high position should give them a moral and cultural obligation to voice their concern to their profession and the public over the extinction of species, the loss of major plant formations, and the horrible destruction of life in the tropics in the name of U.S. foreign aid or the United Nations? If they have some understanding or concern, they do not show it.

All botanists should read the 167-page report by the National Academy of Sciences-National Research Council (Publ. 1405, 1966) "The Plant Sciences Now and in the Coming Decade, a report on the status, trends, and requirements of plant sciences in the United States." For the next ten years, an expenditure of about 1.5 billion dollars is recommended for the Botanical Sciences, or about 150 million a year! The report generously recommends for taxonomy, paleobotany, and plant geography 49 million dollars of general research and training support, and another 35.3 million dollars for special projects and equipment in the next decade. It signals a bright future for numerical taxonomy and "DNA taxonomy." While the total 84.3 million dollars includes a suggested $27.5 million for the acquisition or development of botanical gardens, which certainly is to be applauded, *not one cent* is recommended for the acquisition of study areas, natural areas, or for preservation! Not one penny out of 1.5 billion dollars? Surely, that is blindness! Surely, the authors must know that land for learning is rapidly disappearing. The slant of the whole document is clear: molecular biology is the overwhelming theme, increased agricultural production the background music; poor ecology has no score of its own, being dumped in with physiology. Yet, how are we to teach taxonomy

or ecology 20 or 40 years from now? This report gives conservation lip service in but three places, for a total of 12 lines, with obscure recommendations that species about to become extinct should be salvaged into cultivation. Surely, the authors must know that most plants or animals cannot be brought into culivation divorced from their ecosystems, and that soon the gardens of the world will not be big enough to hold all the plant species that are destroyed by man.

Taking this report of the NAS-NRC, we can see that these highly conservative scientists are fascinated with the latest of fads, that of molecular biology—not to deny its tremendous interest and value! They do not wish to realize that the world's ills are ethical consequences of ecological issues!

Conservation may not be as much a science as an ecological point of view, a morality, an ethics inseparably linked to the science of biology and to human welfare. Intelligent politicians like Senator Gaylord Nelson of Wisconsin are beginning to recognize this morality, and introduce appropriate legislation. (For example, the important "Ecological Research and Surveys Bill," S.2282 of the 89th Congress, and efforts to ban non-degradable pesticides.) Though some problems of food production might well be temporarily solved, they know that the fundamental issue for the human species is not going to be the quantity, but the quality of life. What sort of life shall man, the animal species *Homo sapiens*, lead? Here again, as so often in the history of science, those with a new viewpoint of man's role in the universe, those who now worry about a "land ethic" and a "conservation conscience," have to appeal to the public directly and by-pass the entrenched administrative and scientific oligarchy.

The taxonomist's role should then be clear—he must use part of his energies to educate the public. In this he should feel assured that this is a good time to become involved. Vast changes have taken place in conservation in the last ten years. Destruction is accelerating, but so is biological understanding and efforts for preservation. The many books, from Aldo Leopold's classic *Sand County Almanac* to recent work by Supreme Court Justice Douglas and Secretary Udall on the legal and historical aspects of American conservation, are encouraging signs. Pleas for natural areas appear now even in the AIBS bulletin! The increased influence of The Wilderness Society, the Sierra Club, the Nature Conservancy, the Audubon Society, and others point to an increased public realization that man needs the wilderness.

Recently, Garrett Hardin noted the two most significant publications in biology in the last decade: Watson and Crick's paper on the chemical basis of hereditary material, which ushered in the newest era, that of molecular biology; and Rachel Carson's *Silent Spring*, which forever shook our optimistic blind faith in Science, and, for the first time in history, thrust upon biologists their awesome but inescapable social responsibilities.

Preservation thus starts with your own small efforts. The influence each one of you can have is enormous! What can you do? What must you do?

Even if you are not a joiner, join the two or three national conservation organizations and one or two local groups that are to your liking. Without political implementation all our understanding will be to no avail. You have to rock the conservation boat to make any political ripples.

In your local area, get at least one project underway, not only to get the land preserved, but as an educational vehicle for the public. For, in the last analysis, only an educated public can insure our children a rich world. It is in the process of saving 40 acres of maple forest or three miles of abandoned railroad prairie that you can reach a thousand citizens, and teach, teach, teach!

Instruct your students by example. There should not be a student who doesn't see the unashamed involvement of his teacher in the conservation of nature. There should not be a student graduating in biology who has not read Leopold's *Sand County Almanac* or Rachel Carson's *Silent Spring*, or who has not become aware of what the scientific and social issues are. The time is so short (specifically, the next decade) that a clear exposition of the issues from a biological-ecological viewpoint is crucial. One more generation of ecological idiots is one too many.

We need to watch a major trend in national and state parks of this country that will have disastrous consequences: namely the efforts, under tremendous public and vested interest pressure, to turn our national parks into giant amusement parks and picnic grounds. The proposed Smoky Mountain National Park trans-mountain road and the Grand Canyon dams are but two such controversies, and the end of such perversion is not in sight.

Mostly through United States and Russian leadership, and with the best intentions, western civilization is bringing the blessings of its type of land exploitation to the underdeveloped countries. Should we botanists, in our state universities and with our legislators, not demand that ecologists and taxonomists always accompany such missions? Should we not at least question the killing with 2-4D of thousands of square miles of tropical forests with their tremendous gene pools and their supplanting with mono-plantations of *Eucalyptus*? Should we not ask ourselves whether the prevention of the destruction of the remaining wilderness and the preservation of the remnants of primitive agriculture of the tropics are our responsibilities? Edgar Anderson and Carl Sauer have long pointed out that we have much to learn from primitive people and their ways. Are we, in our Western arrogance, destined to be the executioners of durable agricultural systems?

The NRC report emphasizes the preservation of germ plasm of some economic plants in four proposed centers at a cost of a million dollars a year. Might it not be cheaper to buy areas where primitive agriculture exists with all its genetic and cultural diversity, and agree to keep agricultural foreign "aid" out? To locally "freeze" a landscape

(like the zoning of a town) and to insure survival of the primitive agriculture with its wealth of germ plasm is surely the only sensible way to protect this invaluable, irreplaceable human resource.

And finally, speak out! In our ability to do this we are more fortunate than scientists not housed in ivory towers. So American botanists, don't be afraid, for you have nothing to lose but a raise and everything to gain, including the respect of your students. Some of you, as well as I, may well know what it is to be muzzled. But, hopefully, at my University of Wisconsin, and your university as well, we can at least say what we believe, defend what we know is right.

We, who understand that the basis of human culture lies in the past, we, who believe that man does not live by bread alone, must back our conservation ideals with concrete action. That our prairies and our forests, yes, and our deserts and our waters shall survive and thrive is our responsibility. That these wildlands shall live and bloom for 10,000 years to come is our contribution to human culture and our legacy to our children, so that they, on a warm spring day, can feel peace in a sea of grass, watch a bee visit a shooting star, hear a sand-piper call in the sky, and begin to understand the symphony of life.

So fight, my fellow taxonomists and ecologists—the time is so short!

To describe a biota there is no substitute for a sample. But it is logical to ask, what might one want to know which would require the preservation of a sample? Whether such a question is asked at all is a reflection of the stage of intellectual maturity of a civilization. We take it for granted that there is some social gain in the erection and maintenance of a museum of fine arts, a museum of natural history, or even a historical museum. Sooner or later we ought to be mature enough to extend this concept to another kind of museum, one which you might call the museum of land types, consisting of samples as uninfluenced as possible by man.

— LUNA LEOPOLD

from *The Meaning of Wilderness to Science*

A cinematographer who contributed to Wilderness Alps of Stehekin, *Hessey knows North Cascades trails as well as any man alive. He lives in the eastern foothills of the range, and has long been a member of the board of the North Cascades Conservation Council.*

Gateways to the North Cascades

→»» Charles D. Hessey, Jr.

Cruising downlake on the passenger launch, a perceptive young man from Chicago commented, "I stopped off entirely by accident, and I simply cannot get used to the idea that Lake Chelan has been here all the time and I have never even *heard* of it!"

Westerners have been accused, even by Westerners, of taking their environmental blessings too much for granted, and that the experience of the amazed Chicagoan has been duplicated many times scarcely seems open to reasonable doubt. He knew that what he had discovered was more than just another lake; it was a major geological phenomenon that provided an extraordinary waterway into a range of mountains that he also had found it necessary to discover. Perhaps, had we built the lake and its mountains ourselves, he would have known of them. (He had read all about Grand Coulee Dam and the Floating Bridge.) But Lake Chelan predates Man in these parts and is generally considered to be a work of the prehistoric Chelan glacier. What did the ice do? The ice, which covered everything, worked slowly and with irresistible force for uncounted years, and ground out a serpentine channel over fifty miles long to a depth of 9,000 feet, choked the lower end of the gargantuan furrow with morainal debris, thus making of the furrow a vessel, and filled this vessel to a depth of 1,500 feet with the waters of its melting. Today the lake bottom is 400 feet below sea level, and the summits of its barrier peaks rise above timberline. Forty glaciers—vestiges of the once all-powerful ice stream—feed its contributing rivers. At the foot of the lake the climate is arid, yet from Stehekin, at the head of the lake, the hanging glaciers of Mount Buckner can be seen. As a highway of water that leads into high mountain country from a semidesert landscape, Lake Chelan has few parallels.

The small town of Chelan, center of a fruit-growing district, is the point of departure for the daily boat run. The low hills around Chelan are brown with sun-scorched grass for much of the year, and topped with a scattering of pines. In this fawn setting, patched with orchard green, the lake looks from the highway like a patch of fallen sky.

On a fine summer morning the cool and dry air is as transparent as lens glass, and the early sun, its level rays showering the rippled water with gems, already gives promise of heat at noon. As the launch leaves the dock, inferences of the drama of the trip may be drawn from distant views of the Navarre peaks, first in a long line of summits that form sloping walls more than 8,000 feet high.

At Twenty-five Mile Creek the sense of adventure is heightened by the knowledge that this is as far as cars can go. The water is cool to the touch but still not icy, and the sun will likely be so warm by now that passengers are glad the stop is brief and the boat is soon skimming up the lake once more into the freshening breeze. The mountains on either side grow higher, and from the shadowed couloirs high up on the left shore occasional patches of snow may be seen. The weathered summits to the right look bleak in the merciless light.

It is near the base of Pyramid Peak that realization of entering a different world awakens, for the morning breeze has a bite to it and kicks up choppy waves of gulf stream blue. Rocky points jut from vertical walls, host to lone or scattered pines which winter storms have twisted into caricatures. There are small coves, cliff-girt. To some happy hiker on the summit of Pyramid the launch looks like a white bug on a blue ribbon. A young lady passenger announces proudly that she was on Pyramid last week in a snowstorm. A snowstorm so near in time and distance? The lady looks pleased at the reception accorded her news; secretly, she too considers it remarkable now that she was on the apex of that mighty wedge of rock only a week ago.

The small community of Stehekin lies near lake's head where the Stehekin River, sometimes milky with glacial rock flour, pours its frigid torrent into the lake. The Stehekin valley is still gateway country. The ride up the narrow road can be an adventure in discovery. Just before we reach

High Bridge, the white flood of the Agnes comes in from the west and far back, the West Fork glaciers shine. It is these glaciers that send a heavy burden of rock flour lakeward. The bridge crosses a race of lime-green water that is the upper Stehekin, and a sudden change in forest type occurs. The growth is denser and there are cedars among the pines and firs. Along this road grow some of the loveliest dogwood blossoms it is possible to find, and here too in the deep summer are big blueberries that stifle regret for the withered blossoms.

High Bridge is a hub for trail travelers. The Agnes gorge, in the depth of which the gray water glides with the viscous look of flowing oil, is a short walk westward along a trail that the forest makes a cathedral sanctuary against midsummer heat. The elevation is low even at the West Fork-South Fork joining where the breath of glaciers floats above the water, and this wilderness forest pays for itself in shade.

The South Fork of the Agnes boasts a good trail along a stream that will furnish trailside meals. If not the best fishing, surely some of the most beautiful fishing water anywhere lies downstream from Hemlock camp. Here, as at so many places in the Stehekin watershed, lowland camps are so lavish in their wilderness offerings that a positive effort is required to leave them and proceed to high country.

Back at High Bridge is the start of a trail that climbs 6,500 feet in less than eight miles to the summit of Mount McGregor. Below spreads the Sandalee Glacier. Southward lies the upper portion of Lake Chelan. The valley of the Agnes leads westward to the glaciers of Dome, Sentinel, Spire, and their multitudinous company. To the north, in wave piled on snow-frothed wave of rock, stretch more summits of the North Cascades, while toward the rising sun the tangled ridges roll and diminish in the haze of summer heat. There are those who believe that the essence of this mountain range can best be perceived from McGregor, not through sight alone but through some almost palpable emanation from the grand circle of wild summits that surround this peak. The highest points have been climbed, of course, and who knows what long-ago prospector stumbled laboriously along which savage ridge? Yet one can tell that by far the greatest part of what is seen has never known a human track, and the wilderness force of this furious jumble of peaks and ridges ignites the imagination.

Another hub of radiating trails lies four miles up the Stehekin from High Bridge at Clear Creek campground, near the Stehekin-Bridge Creek confluence. In the two miles from Bridge Creek to Park Creek is a striking forest phenomenon. Here at the modest elevation of 2,100 feet, winter snows are often eight to ten feet deep, and ponderosa pine, Douglas fir, western red cedar, and cottonwood mingle and attain impressive proportions. The unique tree near Bridge Creek, however—it is mentioned in a standard dendrological text—is an alpine fir sharing the same few acres with ponderosa—a most unusual example of coexistence. The lone fir (*Abies lasiocarpa*) is the largest of its kind I have seen in the Cascades. It first drew my attention while I was skiing in the upper Stehekin country one January, and I try to remember to pay my respects whenever I pass that way. Bridge Creek country fascinates the observant visitor with its mingling of eastside and westside weather, forest, and flora.

The Methow River Country

The main drainage artery east of the Chelan furrow is the Methow river, a wonderfully clear stream riffled by bars of granite gravel. The Methow in its upper reaches has two important tributaries. The North Fork, called the Chewack, drains ponderosa country and then reaches far back into the heights of the North Cascades Primitive Area. The West Fork drains an area of imposing rock walls and towers.

Snagtooth Ridge, Kangaroo Ridge, Ragged Ridge, The Needles, Methow Pinnacles, Golden Horn, Tower Mountain. Such names on maps picture the environs of the upper Methow and will set both climber and photographer to wondering. Many years ago, the Fourth of July and a weekend coöperating, we decided to check on the suitability of some of those names. The Methow is ideal for early summer trips because of lighter snowfall and consequent earlier emergence from seasonal austerities.

Our objectives were restfully vague. Camp was placed somewhere near the mouth of Brushy Creek. In the morning there was a view up Tower Creek of the shaft of rock called Tower Mountain, a superbly sculptured monolith. We were led, under perfect skies, through flower-spangled meadows. The trail wound up to Mebee Pass, and on a ridge above the pass we came to an abandoned lookout house. We climbed above it until the copper crags of Azurite Peak loomed over us.

The map we carried brought some order to the chaotic scene. The nomenclature was justified; there was no shortage of vertical rock in the upper Methow. Immediately before us were the serrate Pinnacles. Beyond them a beautiful line of peaks, their basins shining with ice, occupied the place called Ragged Ridge on the maps. In an area that knows no high ridges of another kind, the misnomer is unimaginative at full credit. Still, a cartographer wrung dry of appropriate names was responsible for the measure of delight in our discovery, and we bore him no ill will. One thing we did have to allow was that the cumulative impression of all those names with their implication of severity had not prepared us for the comfortable spaces in the valleys. Here was something for everyone.

At the Brushy Creek crossing was a sign that aroused our interest: Trail Abandoned. With the obstinacy characteristic of people who struggle against gravity for fun, we took the Brushy Creek trail, abandoned or not, and soon found ourselves wondering what odd reasoning lay behind the discarding of a trail so well constructed and so scenic. (Several years later I heard that the trail had been restored to favor and was being maintained and used.) It led to

Glacier Pass beneath an imposing mountain wall that seemed to cross the main divide at right angles, Azurite Peak and Mount Ballard being its dominant features. We took time to climb a peak north of the pass for a good look at Ballard, which plunges forthrightly to the valley of Slate Creek's south fork.

Our own treeless aerie was moated in space of satisfying depth. Across the Methow, the Golden Horn was yearning skyward, Holliway Mountain looking like its slightly undernourished twin. The view westward fortified a truism, that one must go to the eastern part of the range to obtain the finest measure of the western summits. This view includes the larger glaciers, and the aspect is of a mountain range three miles high.

Lost River, Twisp River, and Early Winters Creek are important Methow tributaries. Lost River rises in the North Cascades Primitive Area and spends some of its life underground to rise cold and crystalline for the use and enjoyment of vacationers on its lower reaches.

The valley of Early Winters Creek, now being scarified for the new trans-mountain highway, drains a region of rock pinnacles. Kangaroo Ridge stands like a row of mighty rockets. The handsomest mountain in the Methow valley also sheds its melting snow and ice into Early Winter Creek. Silver Star and its courier spires (Chianti, Burgundy, Chablis) carry small glaciers, although these mountains are considered to be in the dry eastern section of the range. Viewed from the northeast quadrant, Silver Star is outstanding for the superior angularity of its sculpture and for its light-reflecting ice. Those who carry rope and iron to help them overcome otherwise impossible summits should plan a visit to the Wine Towers, for the climbing offers difficulties on excellent rock, and the play is performed in a setting of alpine splendors where the climber can honestly enjoy the feeling that few indeed have preceded him.

The Twisp River enters the Methow at the small town of Twisp, and so varied are its charms that there are those who rarely vacation in any other valley than this one. The lower country is given over to ranches, and much of the wild flavor of the upper reaches has recently been impaired by logging. Yet for a little while longer it will still be our privilege to climb into wilderness on such delightful trails as that to Oval Lakes.

This trail has long been a favorite for its gift of the sense of the wild. It is, at first, an easy trail running companionably close to Eagle Creek, then to Oval Creek, through a mixed forest of evergreens planted in nature's haphazard, healthy, and harmoniously composed way. The waters of Oval Creek sing, through the dappled light, a song ancient and beguiling. The trail traveler glides along borne on the promises the water so musically intones. The mood lasts until a clearing in the trees announces a change in tempo for trail and water. Here a story is told of winter violence, and the path turns and turns again in its steep climb to the treeless heights.

The first lake offers a pleasant invitation to rest. The major delights, however, lie beyond. The trail continues steeply to the summit of the range. Here, above timberline, the ground is carpeted with dwarf specimens of familiar high country flowers—lupine, paintbrush, phlox, and others in great variety. Mountain larch, each tree haloed in the misty green of its own needles, make matchless parks of the basins under the rims.

Immediately to the west is a great void, and beyond it rises a range of mountains as high as nearby Gray and Star Peaks. Directly opposite is a striking feature: Emerald Park, a perfect hanging valley. Merely walking through it cannot instruct the visitor in its perfection; it must be seen from across the void in which Lake Chelan lies.

The trail to Oval Lake number two is sketchy, but having come this far, those who enjoy high trails will want to follow it. Reflecting the granite walls of Gray Peak, the lake is the finest of the group. Its shores are more open than timbered, with red heather adorning the little glades. I thought it one of the finest high lakes I have visited, and the fact that it contains large trout detracts not a bit from its beauty.

Oval Peak, the highest in the area, is nearby and is a simple climb over huge boulders.

The White and Its Tributaries

The White River, which spends itself in Lake Wenatchee, streams through a valley of impressive size and drains many valleys with impressive features. The river trail emerges on the Cascade crest immediately south of the Glacier Peak uplift at White Pass, which is a garden spot. Along the way there are trail miles memorable for their own sake. Acres of tall fireweed emblazon the meadows beneath the emerald slopes of Clark Mountain, where fringe benefits accrue if you decide to rest awhile. Water in the several icy streams originates in snow more than a vertical mile above. It has intervals of glitter coming down when it is whipped almost to vapor in some rocky chute, or pours in a bending plume through space. Miles up the valley the perpetual snows of Thunder Creek flash a white signal.

There are so many things to do in White River country that you could spend a year pursuing them. It is not only the main tributaries that call with insistent voices. One can leave the main trail at numerous places and feel amply paid for the effort. We once did this at Lightning Creek, and fought our way to timberline through vine maple, alder, and shelves of rock. It was strenuous work, and hot, but our campspot was a belvedere of surpassing beauty, and if any other man had once used the place he had left no sign. The following day we climbed steep heather slopes which soon gave way to morainal mounds, and finally to a handsome front of ice at the edge of the White River glacier. This we surmounted to discover a broad, almost level icefield which we trudged across to its joining with the Honeycomb Glacier. To the north then, across miles of ice, rose the white cone of Glacier Peak.

The Indian Creek trail is a part of the Cascade Crest Trail System, which in the northern range is often in the valleys rather than near the crests. Under Indian Head Mountain, gentle meadow country provides the stream a few casual moments in an otherwise turbulent life. Despite the miles and the climbing from road's end, this stretch of water is heavily fished—not, certainly, by fishermen merely intent upon a creel limit. The fishermen who come to this place expect to put something into their souls as well. Here again is that renewing *freshness*. It rises from the verdure to envelop you in a combination of scents; it throbs about you as humming, buzzing, whirring, caroling life; and it ennobles you through a persistent invitation to look up. You do look up where the engulfing green wave of blueberry and heather breaks against long streaks of summer snow, and higher still where the clean hard rock rises triumphant.

Many consider the summit of Clark Mountain to be a more satisfying place than the top of Glacier Peak. For one thing, from Clark Mountain the climber can look across distance to Glacier Peak itself. Moreover, Clark is barely higher than other peaks in its immediate vicinity, so the imposing scale of the mountains is not lost. Set in an area of exceptional beauty, it invites a complete exploration, the most satisfying part of which, to me, has been not on the mountain itself, but the view of the mountain from across the valley on the Louis Creek rim.

This in no way minimizes the satisfaction of looking the world in the eye from the summit of Clark Mountain. The two obvious ways to climb it branch from the Boulder Creek trail. If you carry rope, approach the north side glacier by way of Boulder Pass. The south side is reached by way of a spur trail from Boulder Basin. Neither climb is difficult in fair weather.

In looking for a place to spend a Fourth of July weekend, three of us chose Boulder Creek on the White River from a study of the map. It is far enough east to be relatively free of snow. The trail at that time was a near-vertical eroded groove in the hillside, labeled Stock Driveway on the trail sign. We discovered the basin beneath the soaring east peak to be an emerald jewel, and we pitched our camp there with thankfulness for a purely lucky decision.

We climbed next day to the pass, much of the way on snow. Long before we had reached a point overlooking the east lobe of the Clark Mountain glacier, we realized that we had stumbled upon one of the unheralded scenic climaxes of the Cascade Range.

The spur trail that looped its way up the slope opposite camp traversed a mountain park of great beauty. We toiled up the trail to a spur that runs south from the summit of the east peak of Clark. This spur may be considered the dividing line between the basalts of the Glacier Peak region and the more prevalent granites of the northern range. The spur necessitates a steep descent to reach the mountain's south slope. We chose to start climbing alongside the spur, and were soon involved with *schrund* problems between rock and snow packed to great depths. We had neither ice-ax, rope, nor time, so turned homeward.

The following Friday night found us climbing the stock driveway by flashlight, and spreading our sleeping bags in the trail at the first bench. At dawn we carried our packs up to last week's campsite, then continued unencumbered along the spur trail. This time we carefully descended from the rock rib to the wide slope of the main peak, climbing at first up grassy expanses, then in the welcome shade of a rocky spine where water was foaming. Here Rick decided to rest while Mack and I continued over broken rock to the top.

There was cumulus floating about, and off to the west, Glacier Peak appeared to be floating with it. Everything between the two mountains, it seemed, was glaciers. Directly opposite, the lavender wall of Buck Mountain dipped into a surf of green that surged above the flat emerald floor of the Napeequa, where the silver stream meandered. Below us, and stretching far to east and west, was the robe of ice that drapes the north side of the mountain. A pattern of goat tracks decorated the cornice below the summit ridge, but we looked in vain for the creatures that had walked there.

Presently we descended to where Rick was waiting, feeling sorry that she had not been able to share with us the summit view. But when we reached her, Rick was not wearing the look of someone who has suffered a disappointment.

"Right there, where you are," she exclaimed, "just a few feet away from me, was a goat! He stood there for the longest time and twitched his whiskers at me!"

A mountain can offer many summits.

Western Gateways to the North Cascades

There is less diversity of mood on westside trails, primarily because there is more uniformity in climate on the ocean side of the Cascades. Not merely plentiful, but copious amounts of precipitation are required to produce the magnificent fir forests, the like of which no man will see again outside those areas specifically preserved. The Sauk and its tributary Whitechuck, the Suiattle with its Buck, Downey, and Sulphur valleys, the upper Skagit's Cascade and Thunder arterials have forests containing trees the size of those that once reached from the mountains to salt water. As the trails gain in elevation, the sky is still seemingly supported on great columns of gradually decreasing girth until that dramatic line between climatic zones is reached. Here, in many places, one moves in a stride from a forest of towering evergreens into open parkland.

The rain forests of Olympic National Park are no strangers to snow, and trailside trees along the Sauk, for example, are certainly at home in the rain. Perhaps these snowy Cascade valleys support a lesser rain forest than does the low coastal plain west of the Olympics, but we need not be hesitant about applying the term rain forest to these trees of the western valleys. The alder, the big-leaf maple, the

devil's-club—the trees' size and the moss that adorns them, all attest to the abundance of moisture which nourishes their growth.

The modest elevations of these deeply indented western valleys are responsible for the impressive combination of great trees directly under great mountains. Strangers to the Cascades are invariably misled by published elevations of the peaks. Near the picturesque community of Darrington is 6,800-foot Mount Whitehorse. A Coloradan, mindful that there are cities in his state higher above sea level, might have reservations about its claim to be a mountain; but no one who sees it will deny that Whitehorse qualifies. It towers 6,340 feet above the streets of Darrington, and it wears a tiara of glacial ice.

A few miles southeast of Darrington are Mounts Whitechuck and Pugh, 6,935 feet and 7,150 feet respectively. Both support glaciers. Their summits are only five miles apart, yet the Whitechuck River flows between them at an elevation of 1,150 feet. Here is one of the most dramatic approaches to mountains in America, a fact which has made the Whitechuck valley an area of contention for years in the struggle to preserve adequate examples of our very best scenery. Conservationists have lost to the commodity utilizers too often, and the raw wounds of a demolished forest parallel the road for miles.

The trail to Kennedy Hot Springs is much used, and no wonder, for it is an easy trail through pristine woodland. The forest is not of the same order as that which has already been logged. There are some fine trees, nevertheless, and the canopy is virtually unbroken so that the traveler scarcely knows, as he swings along the springy trail, whether the day is fair or overcast.

The charm of the deep forest is something that is felt at once, but the mood is built up slowly. Contributing to it are slanting bars of sunlight, tall gray and brown columns rising from a tidy carpet of verdant moss, and the exuberant cadenzas of a winter wren.

North of the Whitechuck, the Suiattle River also runs white with rock flour from Glacier Peak despite all that several sizable streams of clear water can do to dilute it. Of these sidestreams, Buck, Downey, and Sulphur, born in a sensational cluster of ice-girdled summits, come in from the north and east. The first mile or so of Sulphur Creek tell the nose where the name came from, but once beyond the springs, one's thoughts can turn to admiration of the magnificent trees in their mossy draperies.

Years ago, at the end of the Second World War, I pushed on to the very end of a neglected trail, making my way, at one place, on hands and knees through towering devil's club. This was jungle—some might say as much a jungle as the Assamese variety I was anxious to forget. But there were profound differences. Here was the tang of coniferous evergreen in place of tropical mustiness. Here was an atmosphere that braced, rather than enervated. Here were no blood-sucking leeches, poisonous reptiles, or man-eating carnivores. My only weapons were a light fly rod and a pocket knife. The rod warded off hunger, and I found two uses for the knife. It cleaned the small Dolly Varden I caught, and it blazed a trail between stream and timberline. I wandered for a day around the high steep parklands south of Dome Peak, then followed my blazed trail back to the valley because of a dark wave of cloud that came coasting in. It was September, and the next morning my high meadows were white with snow.

The Downey Creek trail is typically beautiful. The stream, in its more sober moments, allows the trail to approach. Yet as one climbs away from it, the pulsing sound waves declare that yonder in the green-lit distance the water is uproarious with white laughter. There are places where the horizontal leaves of tall devil's club seem to float in airy layers on the emerald substance of their own filtered light. On gentler sections of ground near the main stream grow a few great gray conical cedar trees. Along these moister areas, the red of oxidized wood contributes to the trail surface, harmonizing in color with uncounted shades of green. We did a quick-step along one trail where yellow jackets, at home in rotting stumps, pointedly refused to share their habitat with us.

In common with other westside valley trails, this one makes easy and pleasant walking until suddenly it bumps against the very foot of the Cascade divide. The traveler, at several places along the way, has a delightful foretaste of the attractions ahead. At the Goat Creek crossing, to look up is to see green terraces divided by flashing water, and broad fields of snow that are almost unbearably bright after hours of the forest's subdued light. Rising above the snow are solid symbols of timelessness, the rock peaks.

The Downey Creek trail ends at the brushy edge of an avalanche area and suddenly steepening terrain. The pass leading to the South Fork Cascade Glacier is 4,000 feet higher. In this area are all the pieces of a perfect outdoor picture: lowland forest, singing waters, timberline parks, lakes, glaciers, summits easy and difficult. A few bucks summer in the high parks, mountain goats roam the peaks, parks, and ice, and bears are common throughout the forest until blueberry time brings them into the lofty meadows where they share the bounty with grouse and ptarmigan.

It was in the early part of August that our party climbed to the pass and crossed the South Fork Cascade Glacier, descending to White Rock Lakes on steep snow. No one who has been there would hesitate to recommend White Rock Lakes as an objective. In terms of alpine satisfaction, they provide perhaps the most enjoyable campsites I have known. We found one flaw only—the raw west wind pouring across snow and ice from the pass. We had to wait until the morning of our departure to discover that the wind is not incessant.

Only one of the lakes was open, the others being still locked under the ice a cold and cloudy springtime had preserved. There are two small areas suitable for camping, but the one offering shelter from the wind was still under snow. The small area we used was flat enough, but in configur-

ation, too much resembled a bowl. Uneasy images lent urgency to the construction of encircling ditches. The moats would help in case of rain, but the amazing porosity of high country soil was our main reliance.

Forcing ourselves to accomplish useful tasks was difficult. There were two herds of goats above us to be watched. A doe with her twin fawns grazed nearby until they caught our scent, then raced eastward in an explosion of energy revealing their shock at our invasion of this remote summering place. Across the rocky outlet channel we found a hen and four chicks industriously spearing ptarmigan food.

Our immediate world met the requirements of any mountaineer's scenic needs. To the west was the pass through which the cold wind poured. We looked at it across two of the lakes. The near one had only a small raft of ice and the sun glinted on the riffled water. Black glacial ice showed at the upper end of the frozen lake, and both lakes were encircled by snow except for part of the south shore where steep rock hemmed them in. The pass through which we had come rose to the north. Slopes below it were of rock, and contained a snowfield shaped like an offset hourglass. The peak to the east where the goats were resting was only patched with snow, and much of its flank was green with dwarf vegetation. Immediately before us to the south was our parlor with the green carpet sloping away, at first gently. The picture on the far wall was of Dome Peak and the Dana Glacier, its naked ice talons clutching clean rock. North, west, south, and through much of the eastern quadrant, the encompassing walls were of rock, snow, and ice. We occupied a small oasis in a sub-arctic world.

From the peak west of camp we saw a band of buck deer in an adjacent high basin. An attempt to approach them for pictures led us to the summit of the mountain, but the deer were gone, apparently down a very steep slope eastward. We photographed no deer, but the pursuit had led us so far that we could now see the ice tongue of the Chickamin, one of the largest glaciers in the Cascades. Near the Dana Glacier, the airy pinnacles of Spire pierced the horizon. The deep valley of the Agnes was the avenue up which the temperate zone crept to lay our green oasis on a frigid shelf.

Today we look backward to a time when there was more wilderness than the people of America needed. Today we look forward (and only a matter of a few years) to a time when all *the wilderness now existing will not be enough.*

It would, I think, be wise right now to stop all new roadbuilding into wild lands, all damming of wild rivers, all logging of virgin forests. The Americans of 2000 A.D. will thank us if we take that course.

If we do not preserve the remaining samples of primitive America, we will sacrifice traditional American values, the values of frontier America. Not every citizen goes to the wilderness—and they did not even 300 years ago. But so long as there is the presence of wilderness and the option of going to see it, a certain number of citizens do go there and bring back a message for their fellows. As long as that continues we will retain a historic connection with the past of our nation—and our race.

—William O. Douglas
from the foreword of *The Wild Cascades*

Saturday Review *published this article by the club's Conservation Director in June 1967; much has happened since, but this remains a basic document in the campaign for a redwood national park*

Why Worry About the Redwoods?

→ Michael McCloskY

As the tallest living things, the redwoods symbolize the force of life itself in a world in which man has crowded nature too closely. Much of what man has done, particularly to the redwoods, is beyond redemption, but because of their size the task of destroying virgin redwood forests is not yet over after a century of trying. We are getting close, though. How short of the mark we stop will be a gauge of the self-restraint we must find if we are to build a better relationship with nature.

From a distance one may be tempted to discount the fight for the redwoods as a classic melodrama of Western politics. Can it be true that conservationists (the heroes) discover a forest of great trees about to be cut by the absentee-owned lumber companies (the villains), and, when a redwood national park is proposed to save the forest, the companies resist? It couldn't be that simple. The issues *must* be more complex—muddied with the gray tones of "the real world." There is no doubt that the dispute has become immensely complicated, but it is just the simplicity of the basic issues that creates incredulity that is politically immobilizing. This incredulity also feeds on an incredible disarray among the forces which should be uniting to promote a park.

The dispute began in 1964 when the National Park Service issued the report of a year-long survey of the redwoods, financed by the National Geographic Society. The findings were that 85 per cent of the original forests had been logged; only 2.5 per cent were protected in state parks; and the remaining forests outside of parks would disappear in thirty years or less. Most significantly, the Park Service found that the largest surviving block of forest also contained the tallest measured tree that they could discover. The National Geographic announced it as the "Mt. Everest of all living things." The Park Service proposed that this 367-foot tree and the great forests around it on Redwood Creek in Humboldt County of California's northern coast be preserved in a redwood national park.

While the National Park System presently contains a representation within Sequoia National Park of the related but quite different species of redwood found in the Sierra, the coast redwood has no representation in the system beyond 485-acre Muir Woods National Monument, just north of San Francisco. A redwood national park would display and protect a truly superior selection of the coastal species.

Spokesmen for the redwood lumber industry immediately opposed the Park Service plan as unnecessary, confiscatory, and economically depressing. They maintained that state parks were sufficient. They worried that the federal government would not pay them enough for their lands or that their lands were too expensive for the government. They contended they were in business to stay, and warned that a park would shrink the tax base and employment. As the controversy has worn on, however, the industry's stance has changed from outright opposition. The first indication of change was the industry's counter offer to sell a few of its best groves to the state park system and to open its logging lands to recreation. To promote the counter-offer, the industry organized a front group disarmingly called the Redwood Park and Recreation Committee. As the park campaign has gained momentum and some of the groves have been purchased, the industry has been willing in a grudging way to accept the idea of a national park as long as none of its lands are involved; it has suggested that one of the larger state parks be turned over to the federal government to be relabeled a national park.

While conservationists have rallied to support the idea of a redwood national park (more than 6,000 letters are in the files of the National Park Service in support of a park on Redwood Creek), a number of conservation organizations have confused the issue by trying to divert the national park campaign to rescue their own lagging pet projects. One organization wants the national park in southern Humboldt County to round out public holdings in the largely unforested King Range. Another group wants the park to include logged-over lands where reservoirs can be constructed to support a warm-water fishery. Finally, after initial apathy, the Save-the-Redwoods League, which has specialized in fund-raising for redwood state parks, has exerted itself to move the proposed nation-

al park northward into the valley of Mill Creek, where its long-term acquisition program for Jedediah Smith Redwood Park is not yet complete. Although the Sierra Club and the majority of conservation organizations persist in supporting the Park Service's original proposal, the impression is that conservationists are badly split.

THE CONFUSION stemming from divisions among conservation groups has been compounded by the gyrations of the state and federal governments. Governor Pat Brown's administration vacillated between wanting the park in three different locations and not wanting it at all, thus contributing to a year-long delay in the Interior Department's sending any bill to Congress. After having campaigned against a park, Governor Ronald Reagan's first move was to simultaneously announce that he was for a national park, which would tie three coastal state parks together with a coastal corridor and assiduously avoid privately owned redwood stands, and then to ask Congress for a three-month delay in taking up the matter so that he could make up his mind.

The federal government's behavior has been even more mystifying. After stressing the urgency of acting before the trees were cut, Secretary of the Interior Stewart Udall sat on the matter for an entire year and then ended by recmending a park in an area not even covered by the Park Service report—an area that contains few virgin forests not already protected by public ownership. After he stated that he did so because he wished "to pick a park, not a fight," the fight became so intense that Udall washed his hands of the matter. Thereupon, the director of the National Park Service explained that the original report of the Service was not followed because it was not "professional."

To rescue some respectability from this debacle, President Johnson and the Senate Interior Committee pressed the companies to stop cutting into the proposed park areas. Agreements were obtained to limit cutting to certain areas until Fall 1967, but in the case of the company with the most impressive holdings, agreement meant no more than that it would stay where it had planned to cut all along.

It's difficult to know what the rock-hard source of opposition to this legislation actually is. The hearing record of the Senate is heavy with support, 3 to 1 in favor of a park, with 94 per cent of the park supporters favoring the Redwood Creek site. In this session of Congress, twenty Senators and forty Congressmen have sponsored bills for a park in Redwood Creek. The price tag is expensive, but barely significant in contrast to the cost of the war and the space program. And if Congress is unwilling to appropriate the full amount ($140 million), park supporters have made it clear that they are willing to apply $60,000,000, or whatever Congress will provide, to the project. A feasible though less desirable park could be designed to fit that amount, and donated funds and land exchanges might make it possible to obtain the whole proposed 90,000-acre park.

If the lumber industry's political muscle has been sufficient to account for slowing this project down, it has not been publicly evident, either at the hearings or in national publicity. Behind the scenes all things are possible. The Administration's strange behavior suggests that something has been happening behind the scenes. It is not clear who is being catered to: the companies, the financial institutions behind them, foundations willing to make grants with strings attached, or certain members of Congress. But it is clear that public opinion is not being indulged, nor are the opinions of the original professional planners of the Park Service.

The Senate Interior Committee will soon begin its deliberations. Mid-April hearings showed no surge of support for the Administration bill. Park supporters, though, did exhibit a growing willingness to be flexible about exact size and boundaries, as long as the core of the Redwood Creek project is maintained. This flexibility even infected the new state administration in California, which backed away from outright opposition and set forth conditions required for its coöperation. Though demanding, these conditions are not impossible. Some may even prove to be helpful.

As these critical committee sessions begin, and with House hearings expected shortly, these things remain clear: 1) the largest concentration of virgin redwoods, of record dimensions and variety, exists on Redwood Creek (a recent study for the National Park Service shows that this area has more than twice as much virgin forest, with six times as much acreage of superlative trees still without protection); 2) this area is being logged steadily, with immense damage having occurred in the past two years alone; 3) preponderant public support for this proposal is a matter of record; and 4) feasible means of financing this project and mitigating its initial economic impact have been demonstrated (most of the companies will stay in business).

It is time that Congress debate the matter fully. Behind-the-scenes negotiations have merely delayed the project and increased confusion. In view of the failure of the Executive branch to develop a responsible proposal, Congress, though not ideally equipped to do so, must now undertake the choice of the location and design of the park. With cutting continuing and slated to increase in the fall when the limitation on logging expires in key areas, Congress must settle the matter in the next five months.

Prologue

»» Edgar and Peggy Wayburn

They were there long before mankind had known there was a Pacific, those immense, incredible forests. From the Big Sur country they extended northward four hundred miles along the wild, rocky, beautiful coast—crowding the broad river flats, clothing the steep slopes, and crowning the ridges. They were forests such as man had never seen, anywhere, with trees so huge it sometimes took a dozen men to circle one—trees so tall no one could know their height until they fell.

The trees were somber Greek columns in muted colors, branches held high, needles delicate against the distant sky. Sunlight slanting through sought out the big-leaf maples, the alders, the dogwood, and the oaks. And in spring, even without sunlight, myriad small flowers brightened the forest floor.

The coast redwoods, *Sequoia sempervirens*, are among the survivors of a great genus. Crowded westward by geological and climatic changes, the tallest living things make their last stand along the rim of the Pacific. From the time of the dinosaurs to the time the white man came.

Spaniards found them, the Russians and Englishmen followed, and the tough pioneers came. The early records are scant, and some are difficult to believe: A tree 32 feet in diameter stood on the Oakland hills, one naturalist noted. Others there were so tall that English sailors in 1816 used them to sight a course from beyond the Golden Gate. Around Bolinas, great groves of redwoods stood "as fine as any," and the Bolinas harbor rivaled San Francisco as a timber port until it silted in.

Eureka was forest. Crescent City was forest. On the Elk River in Humboldt County, a tree yielded 420 feet of logs, and the salmon ran so thick in Bull Creek a wagon couldn't cross it in the spring. It took 15 years of steady logging to cut the great trees of Jolly Giant Creek near Arcata. And everyone thought the redwood forests were without end.

Disappointed goldseekers swelled the ranks of loggers in the 1850's. They turned from the Mother Lode to mine the coastal forests instead. They sailed north from San Francisco, and at almost every creek they discovered a new strike—a grove of trees to stagger a man's imagination. By 1860, they were all the way to Crescent City, and the blue smoke of a sawmill drifted from the mouth of every sizable stream.

In 1879, when the first major proposal was made for a redwood national park (by Secretary of the Interior Carl Schurz), the young industry was becoming Big Business. During the next two decades—while small sporadic attempts were made locally to save trees—busy entrepreneurs succeeded in gathering into private hands virtually all the redwood forests. By 1900 the chance had been lost for the nation to save a redwood park out of the public domain. Parklands would have to be bought back from private owners, and on the owner's terms.

The park idea persisted, and logging went inexorably on. In 1911 a California Congressman introduced a House joint resolution to investigate the "advisability and necessity" of establishing a coast redwood park. His resolution failed. The donkey engine and band saw sped up operations, and by the time passable roads penetrated the redwood region, thousands of devastated acres were suddenly on display. The Save-the-Redwoods League was formed in 1918 to rescue the redwoods, and high on its agenda was the establishment of a national park.

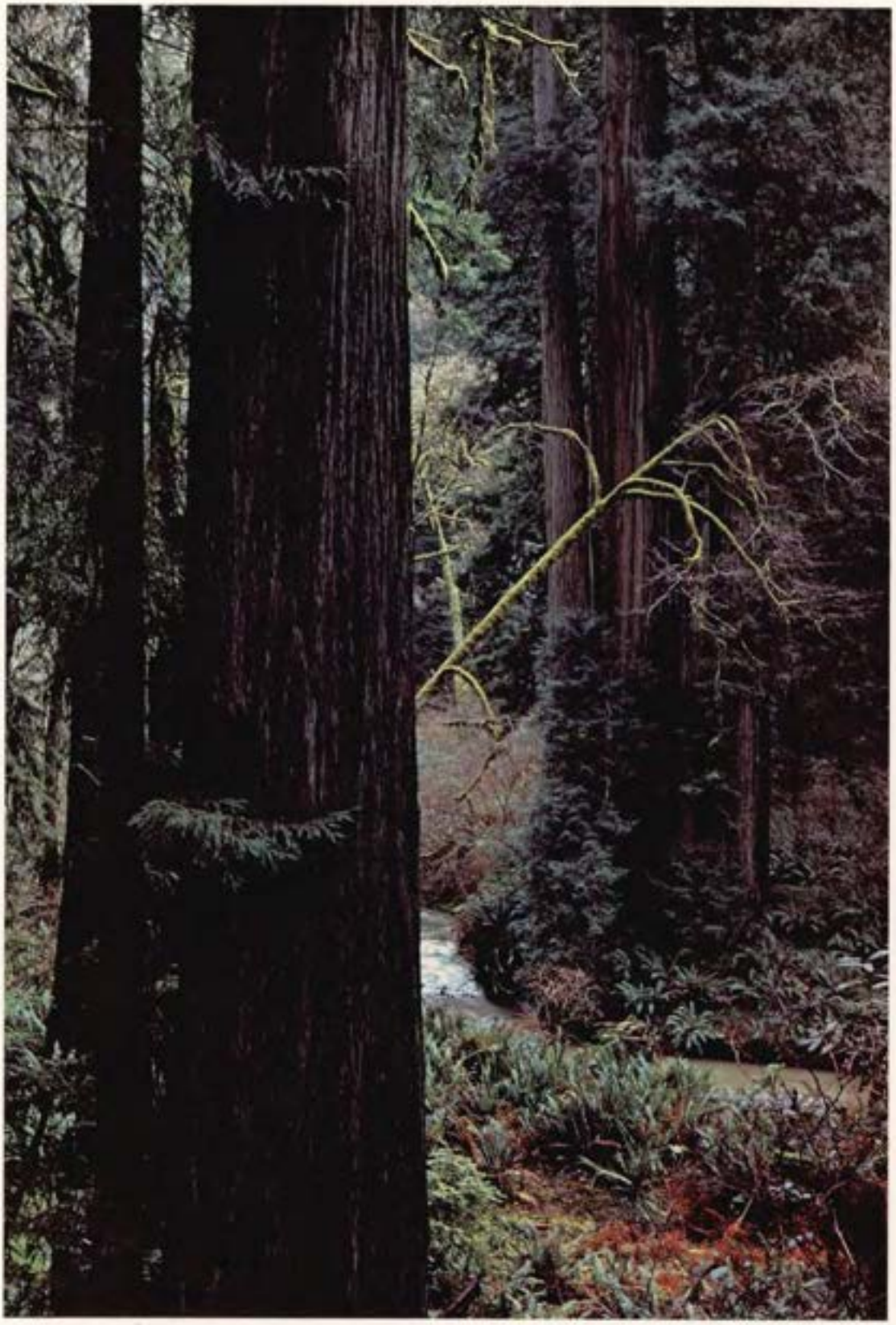
In 1920, Madison Grant, one of the League's founders, wrote in *National Geographic Magazine*, "Four great forests stand out prominently. They are (1st) the groves along the Eel River, culminating in the Bull Creek Flat and the Dyerville Flat; (2nd) the immense Redwood Creek grove; (3rd) the Klamath River groves, and (4th) the Smith River groves at Mill Creek. Each has its peculiar beauty and it is difficult to choose among them." Mr. Grant went on to note that Redwood Creek was "peculiarly adapted for a national park."

A redwood national park bill passed the House in 1923, but died in the Senate. Logging continued vigorously behind some of the roadside strips the League had begun to acquire. By 1942 half the primeval forests had been cut.

The depression brought a chance to buy redwood parklands. Largely through the efforts of the Save-the-Redwood League, the state acquired some of its finest redwood groves—at Bull Creek, Prairie Creek and Mill Creek. The redwood industry was glad to get the money. In 1946 Congresswoman Helen Gahagan Douglas proposed the Roosevelt Memorial Forest, 2.4 million acres to be administered by the Forest Service, and 340,000 acres, including state parklands, to be set aside in four memorial park units. But the economy had improved, and her ideas lost out.

Timber operations continued to accelerate. Chain saws and bulldozers moved into the woods. The great trees fell faster and faster; it now takes less than an hour to fell a giant. The Save-the-Redwoods League fought to make the state parks bigger, and the roadside strips longer. The dream of a redwood national park faded.

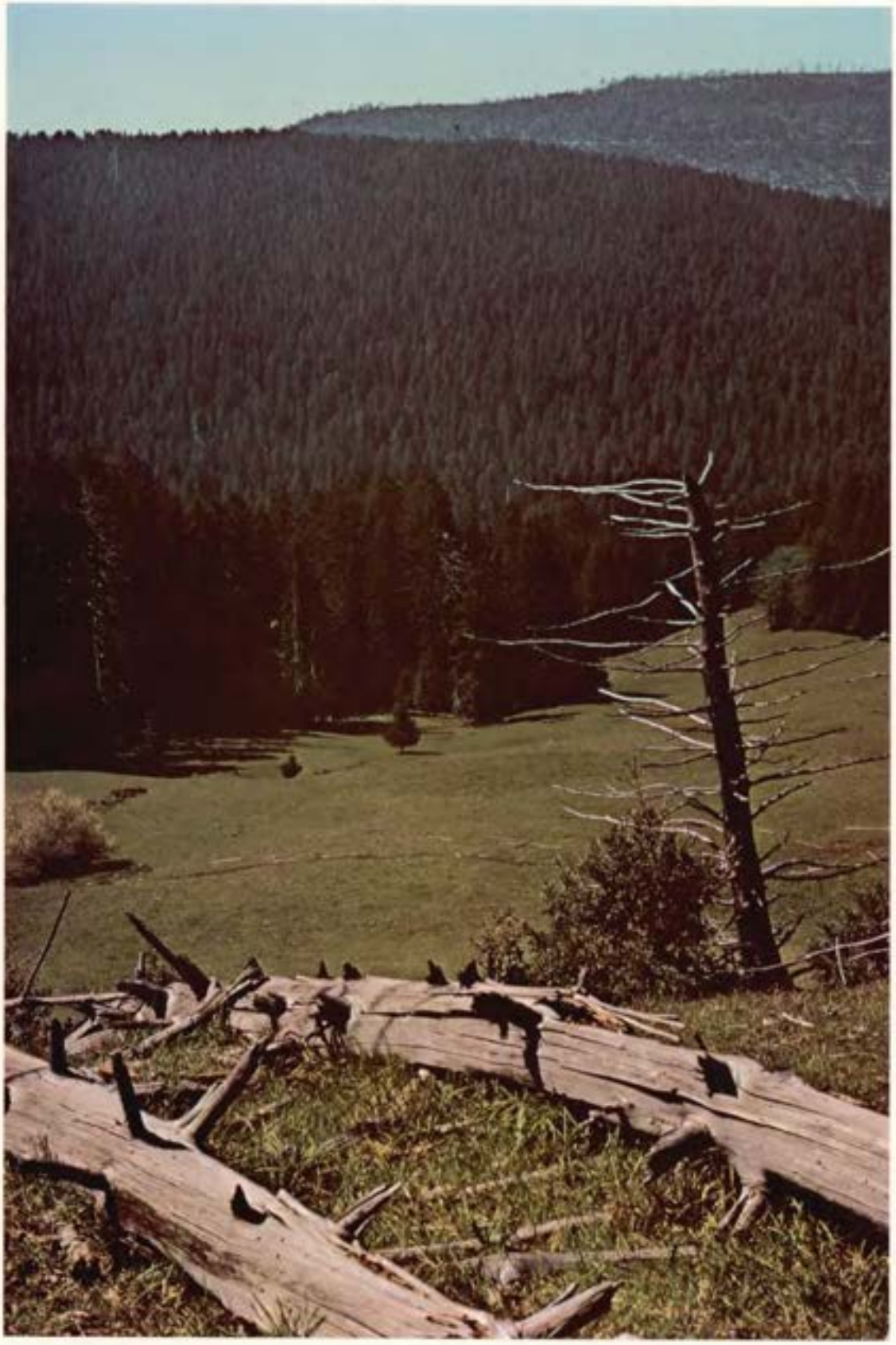
But the dream still has one place to be realized—at Redwood Creek. It is some measure of the redwood forests that, after 115 years of steady logging, such a place remains at all. For one last chance.



In Redwood Creek

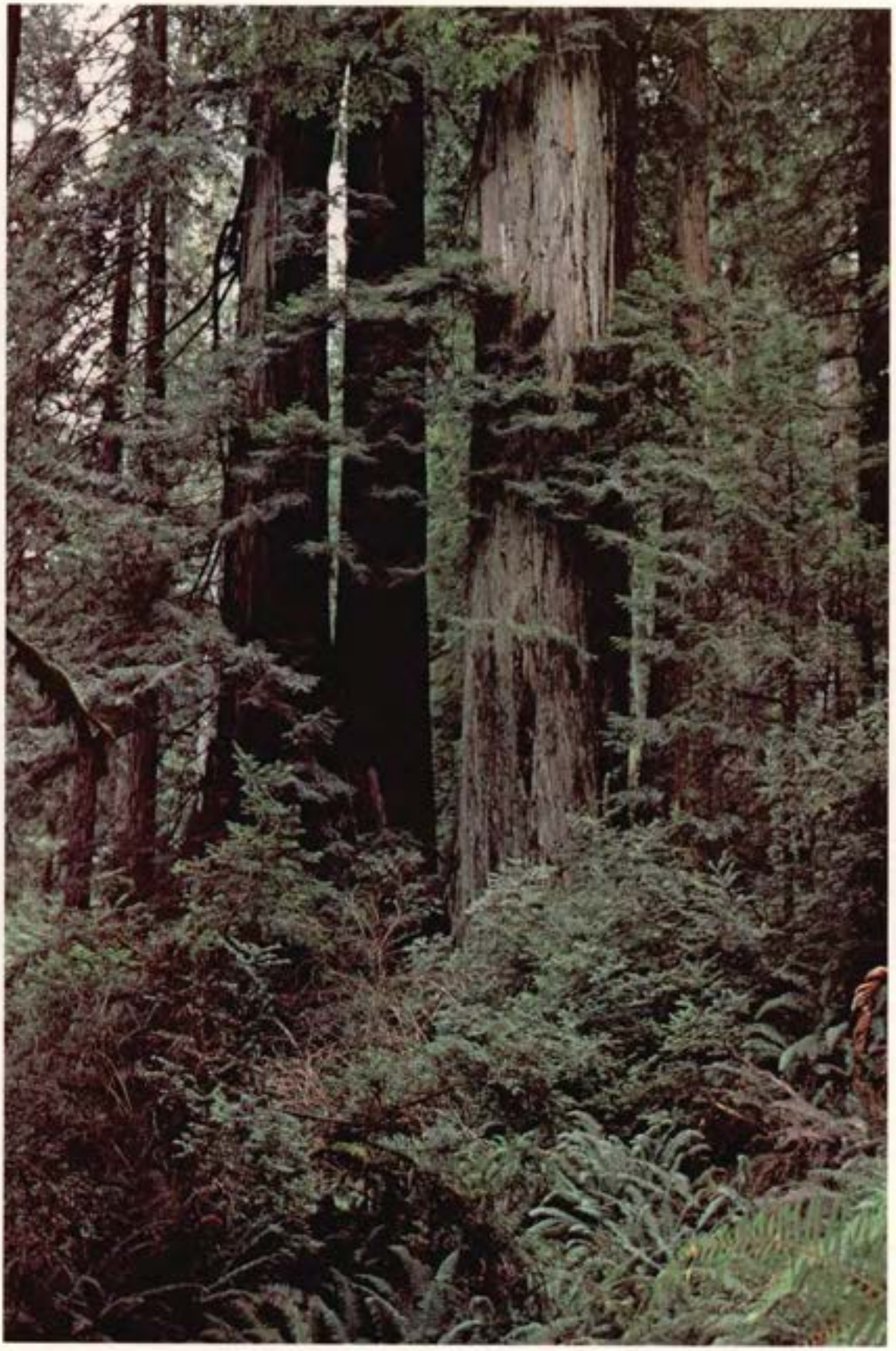
FIFTEEN PHOTOGRAPHS BY JIM ROSE

Lost Man Creek is a place where redwoods were forgotten long enough to survive.

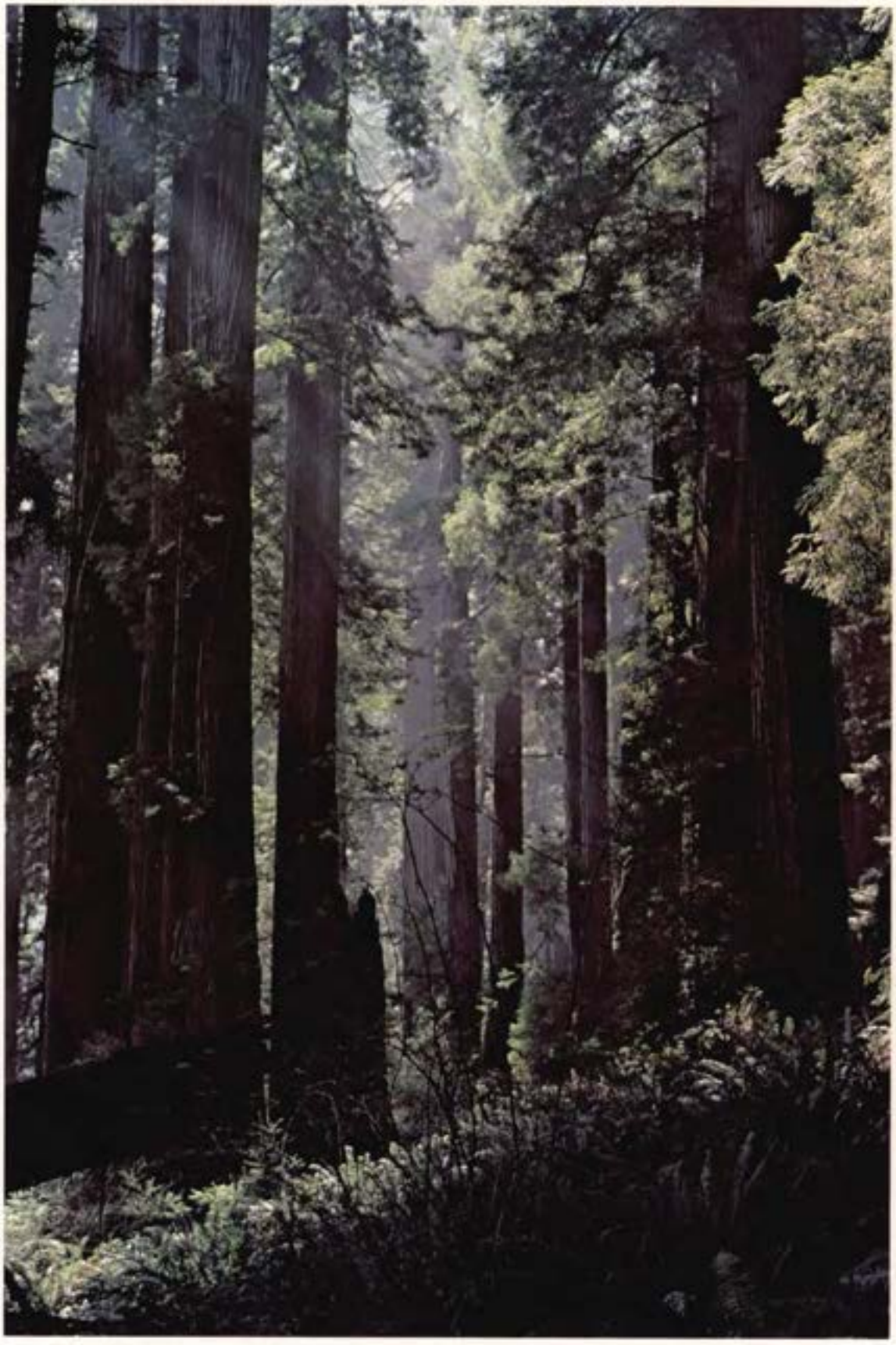


They were forgotten in Redwood Creek too. Beginning where the stream
cuts through the faulted hills to form a narrow level valley,
the primeval forests run downstream for twenty miles.
Balds, like Counts Hill Prairie, lead down into this last great forest.

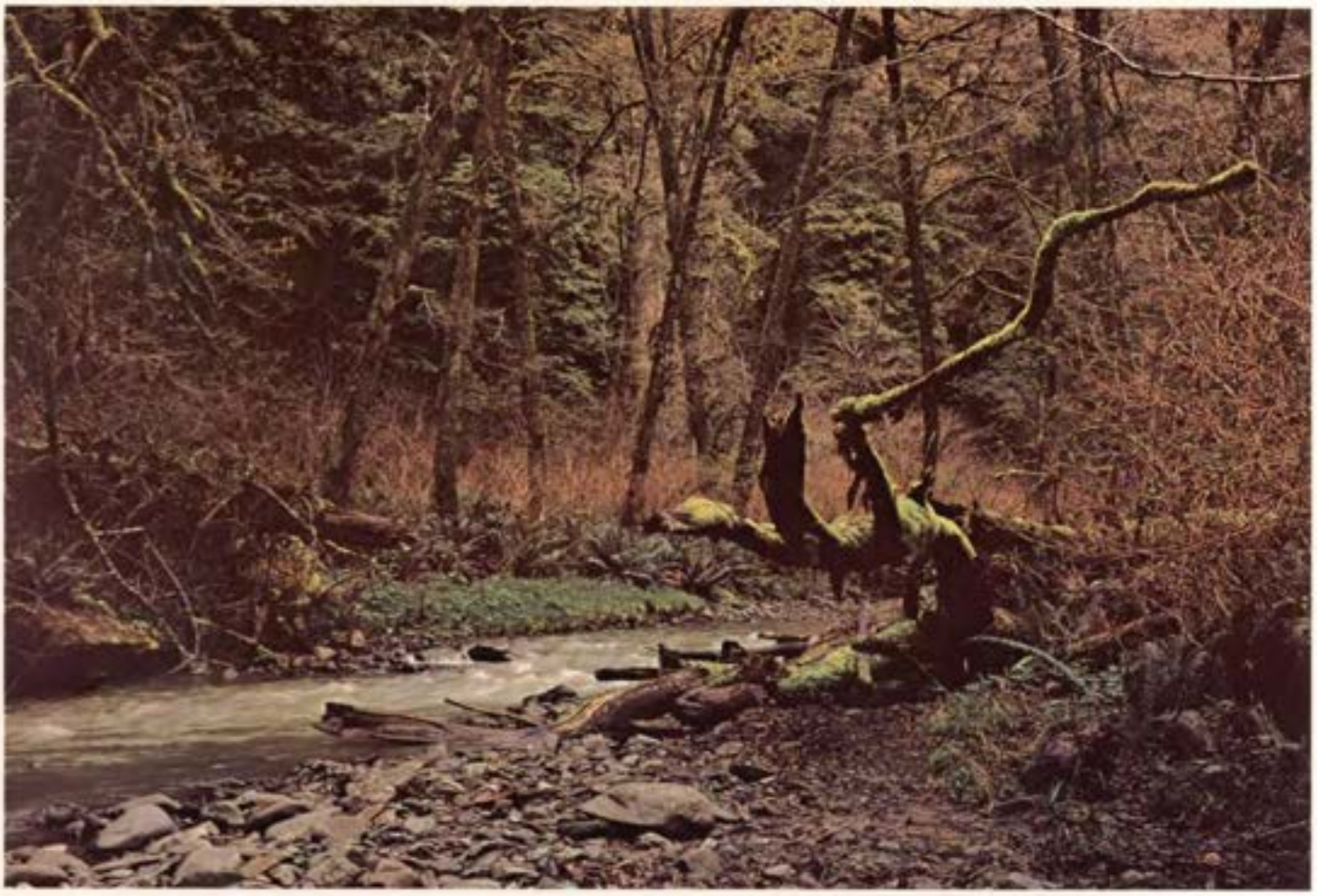
The wall of trees three hundred feet high ends where Redwood Creek widens and curves to reach the sea. From here one can easily move into these forests, to explore an ageless process of life.



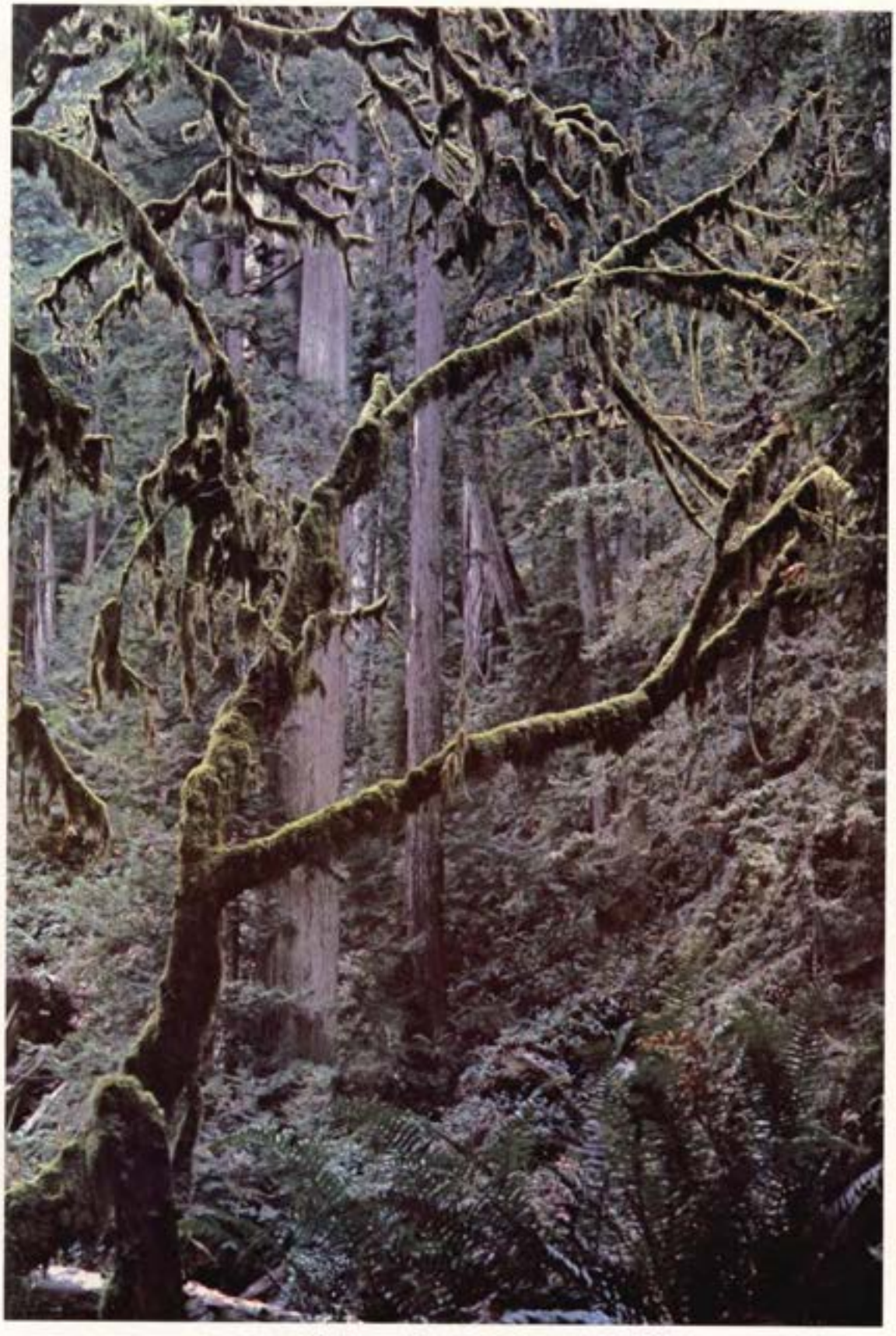
A new sense of scale prevails. With neither roads nor trails to bring you in, you become a part of the living forest that thrives here.



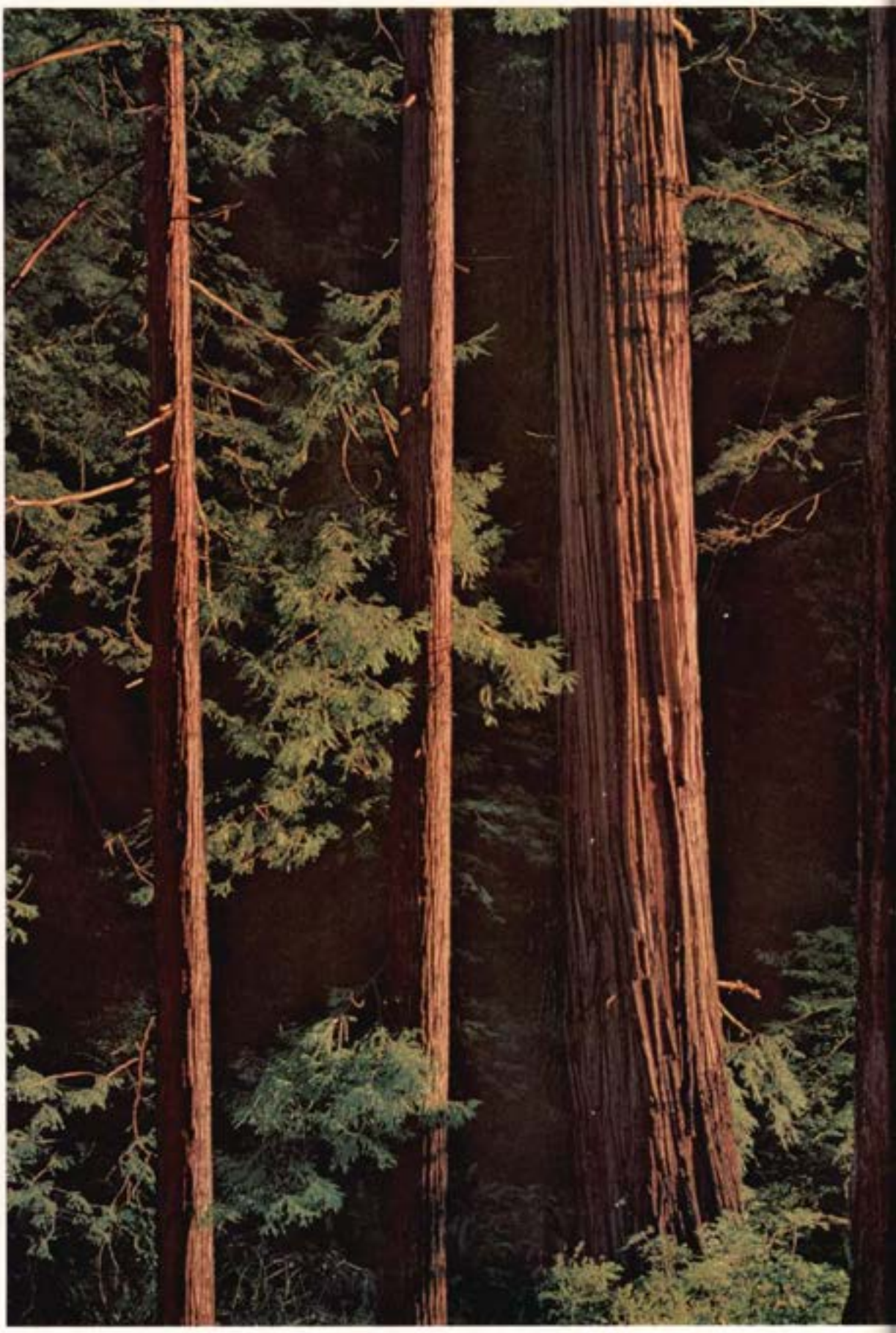
Redwoods move up the slopes to catch sunlight and fog alike.



In a forest still almost virgin, streams like Lost Man
can live within their banks. But with a shade of silt appearing,
how long will ferns still spread to the water's edge?



A mystery grows here, compounded of ferns and moss,
with maples and redwoods rising through it all.



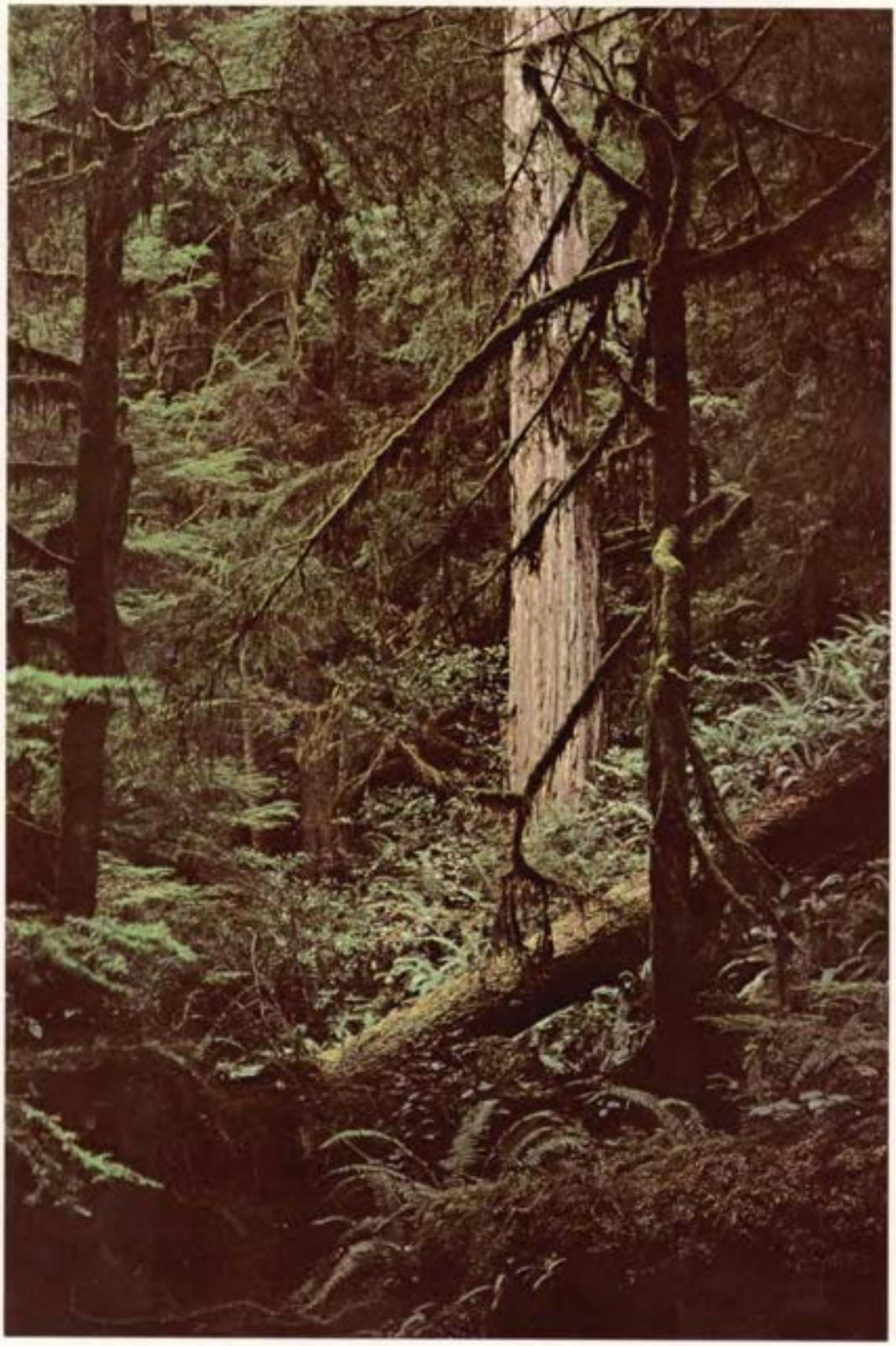
Only occasionally can the sun reach into the flats to brighten heavy trunks.

There is a quiet partnership of water, light, and woods which all could enjoy—if we protect it.

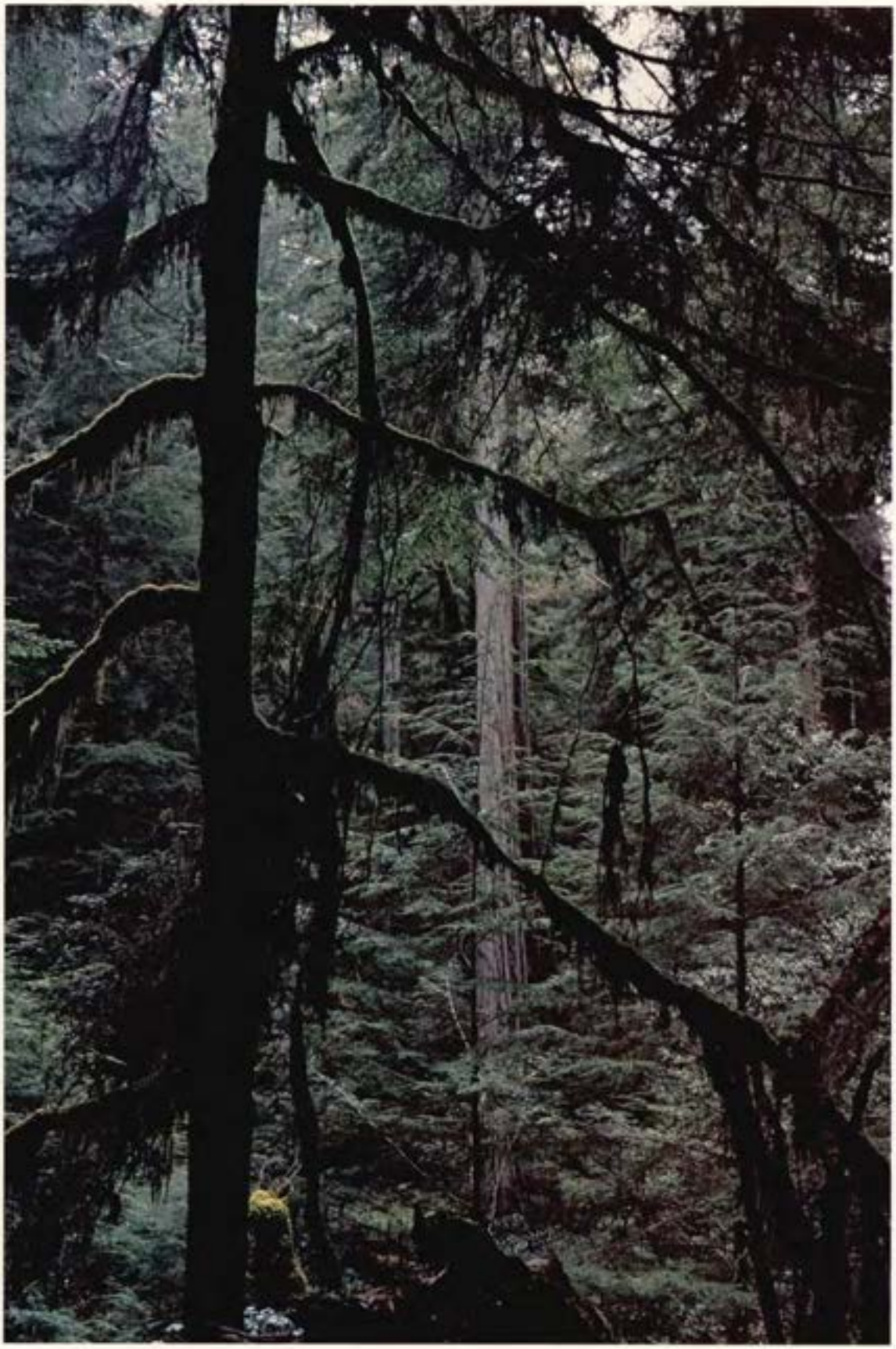
But this area has no protection now.
The superlative stands of Lost Man Creek are going down — daily.
A last large forest of such trees can still be rescued.
In 1965, the Arcata Redwood Company began to move into it.

Logging in the North Fork of Lost Man Creek, 1966.

Lumber companies say slope timber like this is not "park-type" timber.
If enough people do not learn what this forest is really like,
it will soon cease to have timber of any kind.



We have a choice. If we care enough, the greatest remaining stand of virgin redwood can be protected forever in a Redwood National Park.



Epilogue

EDGAR AND PEGGY WAYBURN

THINK, IF YOU CAN, of the time contained in a million years, of the days and nights in ten thousand centuries, of the mighty forces of the earth working throughout that length of time on the land where the redwoods grow. How many storms swept in from the sea to beat against those shores, how many savage winds and tides and floods? How many wildfires raced unchecked? How many earthquakes shook and shaped that land?

Think of a forest living on through all those adversities as the redwoods did along the foggy rim of the Pacific, trees having within them a mighty will to survive. Some trees stood for more than 2,000 years and when they fell, there were others left to go on living. The continuity of that great forest was not really challenged until man, with his ability to change and destroy, found it. Now, in a little over a century, most of the primeval forest has fallen, and it is still falling.

If there had been no redwoods, man doubtless would have managed. But there were redwoods, and there seemed to be so many reasons to cut them. (Somehow we always contrive to explain, to our own satisfaction, the things we do because we feel we must do them. There were reasons when the hillsides of Lebanon were stripped bare, too.) There were cities to be built and rebuilt, there was the market for shingles and shakes and sidings, for grape stakes and railroad ties, for fence posts, cigar boxes, coffins, panels and patio furniture.

And so, for every 100 acres of redwoods that we found, we have cut about 90. Because some people cared, we have dedicated about 2½ acres out of each 100 for California redwood state parks. Some of these fragments of the primeval forest are small, almost as tall as they are wide. But you can walk among their trees and consider the long, dim corridors of time and sense how the world was a million years ago.

How "saved" these redwoods are we do not know. Hundreds of the greatest park trees have been toppled by floods made lethal with run-off from stripped watersheds. Some of the best park groves have been severed by a freeway, their dignity and quietness lost in the roar and smell of trucks and cars. Other fine parks are threatened with the same fate. Logging defines the boundary of almost every park, leaving trees exposed to wind and storm.

And the forests we have cut? For decades they fell like the great forgotten forests of the east—the pines of Maine and Georgia, the hardwoods of Ohio—without thought or plan or care for the land. But the will to live is deep within the redwoods, and the great stumps try hard to sprout new trees. In some places, new forests have come back in fortuitous second growth. In other places, they have not grown again and no one knows just why. The scientific study of redwoods is recent and still experimental.

The men who are cutting the last primeval redwoods today—and who want to cut on to the end—are very reassuring. Many level the forest and scrape bare the forest floor with bulldozers, and re-seed with fir and pine and spruce where the redwoods grew. They speak of harvesting overmature trees, of tree-farming and sustained yield. Sometimes they talk of growing redwoods like a crop of corn. But the economic crop, and the crop they plan to grow, will be for pulp, and this they say honestly.

What this honestly means, of course, is that where the great trees once grew for centuries, small trees will stand for 40 years or so. The land that bore the giants will bear striplings—as long as it bears anything. There is serious question as to whether the steep, fragile slopes of the redwood region can survive "sustained yield" as it is practiced. In too many places, bedrock has already emerged, the rivers are thick with silt, the streams are ugly gullies.

The hour is very late for a redwood national park. The time of choice is gone. Of the four great forests Madison Grant described, just one survives with a national park potential. The groves of the Eel, the Klamath, and the Smith have been logged too long. At Redwood Creek, the last great contiguous groves are left, with trees to equal any, and a sweep of forest from coast to ridge top with marvelous complexity of the redwood forest flora. This is the last chance to save enough.

But in a democracy, the machinery to make a park grinds slow. We take time to argue, especially where money is concerned, and this park must be bought. While we argue, the chain saws are not idle. Dozens of trees can fall in a day. A bulldozer can tear apart in a morning the soil laid down for a hundred centuries. And men who do not want this last-chance park have the power to destroy it.

If they do destroy it, if we let them, if we find it too costly to stop them, how will we explain to those who come after us? Redwoods are unique among all living things on earth. All men should have a chance to stand among the ancient forests, to touch the trees and reflect on how life can continue on this planet. Timeless until we came, these forests are entitled to survive, let us say, even if there were no men at all. If they are our heritage, we are their stewards. Just how responsible is our stewardship?

Somewhere, on the Colorado before it pauses, momentarily, in the reservoir backed up by Glen Canyon Dam, scoop up a cupful of river, let it settle, and consider the sediment in the bottom of the cup. It has more story to tell than tea leaves ever would. All you have to do is contemplate what the sand there does if it is free—such creations as the Grand Canyon, for example. And what it will do if man tries to entrap it. Read on, and be frightened a little.

Sedimental Journey: Grim Prospect for the Colorado

→»» David Brower

When the Bureau of Reclamation boasts of turning into sparkling blue lakes and crystal clear streams good for fishing something that had previously been too thick to drink and too thin to plow, there is a tendency to share the Bureau's delight. But there is a good question to ask before we get too ecstatic: What happened to all the sediment and debris, all the silt and sand that gave the Colorado its color?

In the first place, for a whole series of reasons, many of them consisting of abusive treatment of the land, the Colorado tributaries are still stripping just as much off the land as ever and starting it all down to the Gulf of California. Sooner or later, it will arrive there. In geological time, all the reservoirs man builds on the river will become filled with sediment, filled to the brim and more. The river will cascade over the dams, finally erode them, and in the end transport the sediment to the sea, cleaning out its channel; revealing once again what was buried there, and resuming the work rivers must always carry on—the constant attempt to level the land.

Long prior to this, man may have disappeared from the earth. So a different perspective is worth while: What will be the immediate effect on this civilization, on the generations of people those of us now alive will know and must feel some responsibility for, of the sedimentation of the Colorado River reservoirs now existing? Of immediate importance, how about sediment and the proposed Grand Canyon dams? For the foreseeable future, what kind of storage loss and water loss can be expected? What validity is there to projections of long-range revenues, for example, if there are poor forecasts of sedimentation rates and if it is assumed certain reservoirs will be storing water, conserving water, and producing hydroelectric power for longer periods than they actually will?

First, let's put down the statistics we know, then decide what they will allow us to predict. Note: If statistics are what you don't need, skip the next eleven paragraphs.

For sedimentation rates on the Colorado, House Document 364 (1954) showed that 100,000 acre-feet of sediment passed the Glen Canyon damsite each year. This, then, is the amount that is now beginning to silt up Lake Powell, with a water capacity of 27,000,000 acre-feet.

Walter Huber, the late former president of the American Society of Civil Engineers, and an expert on dam construction and operation who was well aware of Colorado River hydrological statistics, told me that one-third of the silt that went into Lake Mead came from the Little Colorado River. If you assume, then, that 180,000 acre-feet went into Mead (before Glen Canyon Dam), then 60,000 would come from the Little Colorado, 100,000 from the Main Stem above Glen, and 20,000 from all others. One of the siltiest others is the Paria, which flows 22,600 acre-feet per year. Other tributaries would be the Virgin and the host of minor tributaries within Grand Canyon's limits—Kanab, Havasu, Tapeats, Spencer, Quartermaster, Separation, and so on.

In the early predictions for Bridge Canyon dam, with no upstream sediment control, a 27-year silt life was predicted. (Bridge was renamed Hualapai to mollify the Indian tribe by the same name, which happened to own the left bank of the river at the damsite and also happened to oppose a federal dam there. The renaming was doubly expedient because Bridge was getting a bad name. But, as a name, Bridge is good enough for us.) The capacity of

Bridge at elevation 1866 is 3.7 million acre-feet (maf henceforth), its surface area 16,700 acres. The capacity of sediment would be perhaps 25 per cent greater than the capacity in water, assuming headward aggradation (the upstream grade a river builds back from the reservoir that stops it) from the dam itself that would produce a grade of 1.5 feet to the mile. This figure must be predictable and the calculation should be checked. If it is correct, 125,000 acre-feet of sediment passes Bridge Canyon site, or enough to render the upper 40 miles of the reservoir recreationally unusable in 3½ years—assuming no upstream control. (There is now major upstream control, remember, in Glen Canyon—until its reservoir silts up.)

As a cross check, the Southwest Water Plan, 1963 edition, shows 2.1 maf capacity for the Coconino silt-retention reservoir, and the Pacific Southwest Water Plan Supplement on Bridge says this will last 100 years. Add 25 per cent for aggradation, or 3 maf, divide by 100 years and you get 26,000 acre-feet/year Little Colorado sediment. This is less than half what our previous estimate shows. This may be explained if it is really a gross underestimate of the Coconino sediment capacity. Considering the shape of the Coconino impoundment area, the gross underestimate is possible. The area is 76,000 acres when full of water. Bridge Canyon reservoir, for comparison, is 16,700 acres for 3.7 maf capacity, versus Coconino's 76,000 for 2.1 maf capacity and compared with Glen's 176,000 acres for 27. maf capacity. Thus, in acres per maf capacity: Bridge, 4,500; Glen, 6,500; Coconino, *38,000*. So gently sloped a basin might aggrade unconscionably. If aggradation doubled Coconino's capacity for sediment, as compared with its water capacity, we'd get our 60,000 acre-feet per year of sediment—and an incredibly big silt trap, of perhaps a 150,000-acre surface.

A 1949 publication of the Bureau of Reclamation (N.H. Daines, *Study of Suspended Sediment in the Colorado River*) may be too old to be of much help. It shows an average of 175,000,000 tons per year of sediment discharge at Grand Canyon station (probably near Bright Angel Creek), 1926–1948. At an assumed density of 1.1, this is some 150,000 acre-feet of sediment at almost the Bridge site (albeit, some 120 miles above it, but with little silt entering between). The bedload was not measured, but that could hardly explain the difference. Bedload is what you can't dip up, let settle, and record in a field station. But sometimes you can hear it moving when the river is in full voice.

So we probably shouldn't place much store in the Daines opus. An interesting figure of his may be worth noting: 90 per cent of the water and 60 per cent of the sediment of the Colorado comes from above Glen. Reading this backwards, 40 per cent of the sediment comes from below Glen, and it would be easy to estimate that one-third of the sediment in Mead would come from the Little Colorado. Just what Walter Huber said.

In the Pacific Southwest Water Plan Appendix, the Geological Survey lists all kinds of plans for studies, but none for studies of sedimentation. In pursuing sedimentation data at the USGS in August 1966, Hugh Nash was told that the USGS was not permitted to make sedimentation projections.

Now for a couple of flow figures. What's the Little Colorado got? Using the 90–10 ratio above, and taking some flow figures accompanying a letter, August 3, 1966, from the Bureau of Reclamation to Walter Edwards, we find the virgin flow at Lee Ferry, 59-year average, is 15,025,000 maf; 90 per cent of that leaves 1,503,000 for the Little Colorado and associated streams below Lee Ferry. The Paria average, 1914–65, was 22,000 acre feet, so we can say the Little Colorado does about 1.6 maf per year. (Note: it's really nearer 300,000; but don't worry. Errors like this don't matter much in the life of a civilization and not at all in the life of a river.)

One further detail about the proposed Paria dam and we can close up the data gathering and see what to do about predicting.

The Paria silt-detention reservoir holds 98,000 acre-feet of water. It is 13 miles long and has an 8,000-acre surface according to the BuRec map (2,500 on the area-capacity curve in the same supplement!). Note: Although the Southwest Water Plan says 98,000 acre-feet capacity, the Marble Supplement says 235,000 in text, 200,000 being all that shows on the area-capacity curve accompanying the text. The text says there is 5,100 acre-feet of sediment per year between Glen and Marble, with the Paria contributing about 4,475 annually (a nice precise figure, that one). The dam is 18 miles up the Paria, with some 250 square miles of Paria watershed below the dam, so perhaps 4,000 acre-feet per year will end up in Paria until it is full, in its century; the rest ends up in Marble, which has only a 363,000 acre-feet capacity.

All we have seen so far is that it isn't easy to get figures that check out. If my arithmetic is bad, I've been working too long with Bureau of Reclamation figures. Remember that, depending upon which page you read of their figures that are in the evidence before Congress, the Paria silt trap has an area of either 2,500 or 8,000 acres and a capacity of 98,000 or 200,000 or 235,000 acre-feet. Vote for one—and then move on to something stranger still. The Federal Power Commission has been told that the Marble Canyon reservoir would hold 480,000 acre feet of water and that without the Paria silt trap, Marble would be silted up in 104 years. The Bureau of Reclamation, with the same dam, would have a reservoir with one-fourth less capacity—so it would silt up in 71 years (assuming Glen Canyon Dam still works; otherwise four years' silt would finish Marble). So Marble would be gone in ± 7 decades (i.e., before it is as old as the Sierra Club) unless Paria were built to extend Marble's life 25 or 60 or 70 years, depending upon how you voted on the Bureau's credibility gap.

If there seem to be too many figures, don't let it bother you. They don't bother the Bureau too much, so why

should you worry? Reclamation Commissioner Floyd Dominy told me and a New Mexico radio audience in November 1966 Glen Canyon would never silt up; apparently he doesn't take his own Bureau's figures seriously, even though he has wanted you and me and 200,000,000 Americans to put up the money for the dams his figures advocate. So in its first century, to go into more figures, Marble would be ⅔ (or 1¼) full of sediment and be having troubles in power generation and with clogging up Glen Canyon's tailwater. Marble would be quickly finished off thereafter if the Paria detention dam were built—and done in by silt. The closer Marble gets to its death, the more the reservoir must fluctuate daily to put its peaking-power water through the turbines. The initial ten-foot fluctuations would get grimmer and grimmer, and would probably exceed 100 feet daily in the vestigial puddle at the lower end of the Marble Canyon sediment flats.

Note in passing that with the Paria averaging 22,600 acre-feet per year flow and 4,475 acre-feet per year of it sediment, a cupful of Paria will not stir easily—it is flowing 20 per cent *non*water.

Before we leave the Little Colorado, with the sun setting fiercely in the West, we should look at the Southwest Water Plan supplement map of the Little Colorado's Coconino silt-retention reservoir basin. As scaled on the Bureau's map, it has about one-eighth the area of Bridge Canyon reservoir. Yet we know from the text that Coconino's area is *4.5* times that of Bridge. Error factor: *3600 per cent!*

Now let's start a preliminary summing up and assessing of error of a dimension that should produce shock.

1. Nowhere do we have a reliable estimate, or more than detached pieces of estimate so far removed as not to fit together, of what the all-important sedimentation rates really are.

2. The U.S. Geological Survey, one of the few remaining objective agencies that John Wesley Powell hoped to have so many of, is not permitted to make sedimentation predictions. If it is permitted, really, and someone merely misspoke, where are their predictions?

3. The Bureau admits 20 per cent sedimentation in the Paria, 0.6 per cent in the Colorado above Glen, and an approximate 1.4 per cent in the Little Colorado. The wide range is cause for suspicion.

4. Depending upon which page you read, you can fill in a table as you like it. Herewith the table. Please fill in your own figures and color them fuzzy.

RESERVOIR	WATER SURFACE (*in acres*)	WATER CAPACITY (*acre-feet*)	SILT LIFE (*years*)
Paria	2,500–8,000	98,000–235,000	
Marble	4,000	363,000–480,000	
Coconino	2,000–76,000	2,100,000 or so	
Bridge	16,700	3,710,000 or so	

The last column is too uncertain to worry too much about now, but don't ever forget it.

About that headward aggradation of 1.5 feet: The mechanics of this aggradation will always puzzle me, but I can imagine that if carrying capacity varies as the sixth power of velocity, then when a river slows to half its speed, it must dump 98 per cent of its load. The slowing happens gradually, not all at once; but in any event the river has to figure out what to do with all the water and silt it has when it must dump the silt but still get the water on toward the sea. So a river will build maneuvers to give itself room to meander. In some situations it will cross itself up, dumping the load so fast it has to ride on ridges instead of in gulches. Slow China's Yellow River with dikes and it will ride higher than the land the dikes seek to protect. On a steep alluvial fan, with a flash flood and boulders rolling at an alarming clip, a stream can apparently lose its mind. In a restricted canyon like the Colorado's, where the river builds bars and the side streams tear them apart and build dams, and the river tears *those* apart when it is up to strength, the things a Colorado River will do when a 736-foot concrete clot is poured into it are not yet really quite known. Happily, no one has yet tried to dam the Grand Canyon and the Colorado River that runs through it was able, because of the sediment, to carve the canyon. All we can do, until too late, is to postulate. Better postulate than never.

A point in passing: If the 1.5 feet/mile is too much aggradation, then there will be less immediate damage to Grand Canyon National Park and Monument, et al., but there will be much more immediate damage to the economics of the Lower Colorado Basin Plan because the reservoirs won't last long enough to pretend to pay for it.

In the worst case, for the economics, we have 6¼ maf capacity in the (Grand Canyon; i.e., Marble, Paria, Bridge Cononino) 4-dam complex, a river that has about 100,000 acre-feet per year to fill it, and a 4-dam silt life of 62.5 years. Looking backward, this takes us just about exactly to the year Theodore Roosevelt said of Grand Canyon, "leave it as it is." If they had paid as much attention to him then as the Bureau of Reclamation fails to pay now, all four dams would be through today. And their revenues would have been diminished to one-half when FDR declared a bank holiday and beer came back.

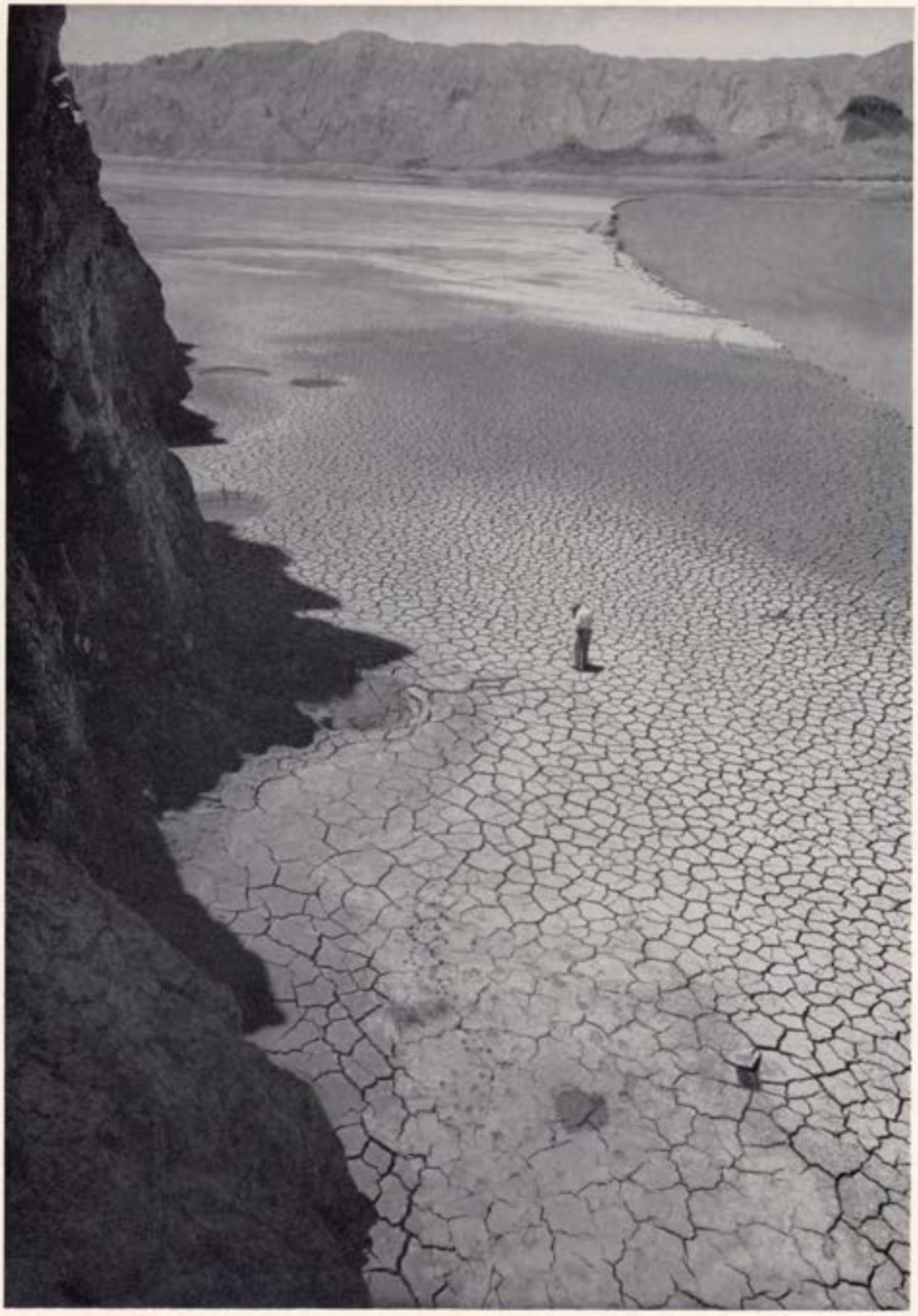
In the best case, we can add some 25 per cent to the silt capacity, since silt slopes better than water does. We can drop the Colorado's silt habit index to half. That would be about 8 maf silt capacity, 50,000 acre-feet per year of silt doing it in, and 160 years to go. Power revenues would be on a half-life basis.

But don't cheer too fast. The Colorado River flow records are brief. We have a nice 59-year average. But those 59 years have not yet included a once-in-a-century flood. The California redwood country had a once-in-a-century and a once-in-a-*millenium* flood within a single decade. So don't place your bets yet. Remember that constant: the carrying capacity of the Colorado varies as the *sixth power* of its velocity. If at 6 miles per hour it can carry

The Life and Death of Lake Mead

Grand Canyon's lower end is marked by the water gap (right of center, in distance) where the Colorado River breaks through Grand Wash Cliffs near Pierce Ferry. If Lake Mead reservoir were full—it almost never has been—it would cover silt beds in the foreground and back water 40 miles past Grand Wash Cliffs into Grand Canyon. Silt, which drops out of suspension when the Colorado's current slows near the head of the reservoir, was deposited in slack-water shallows when Mead was higher. When water level fell, the Colorado cut a new channel through the sediment it had deposited. Slumps and crevasses show that countless tons of silt are sloughing into the river, to be carried farther downstream and dumped again—nearer Hoover Dam. Within a few centuries at most, the process that has begun here will make Mead a vast dry lake—useless for power generation, irrigation, storage, flood control, water sports, or any other constructive purpose. Proposed Marble Canyon and Hualapai dams in Grand Canyon, with much smaller capacity, would silt up faster.

PHOTOGRAPHS BY MARTIN LITTON; TEXT BY HUGH NASH

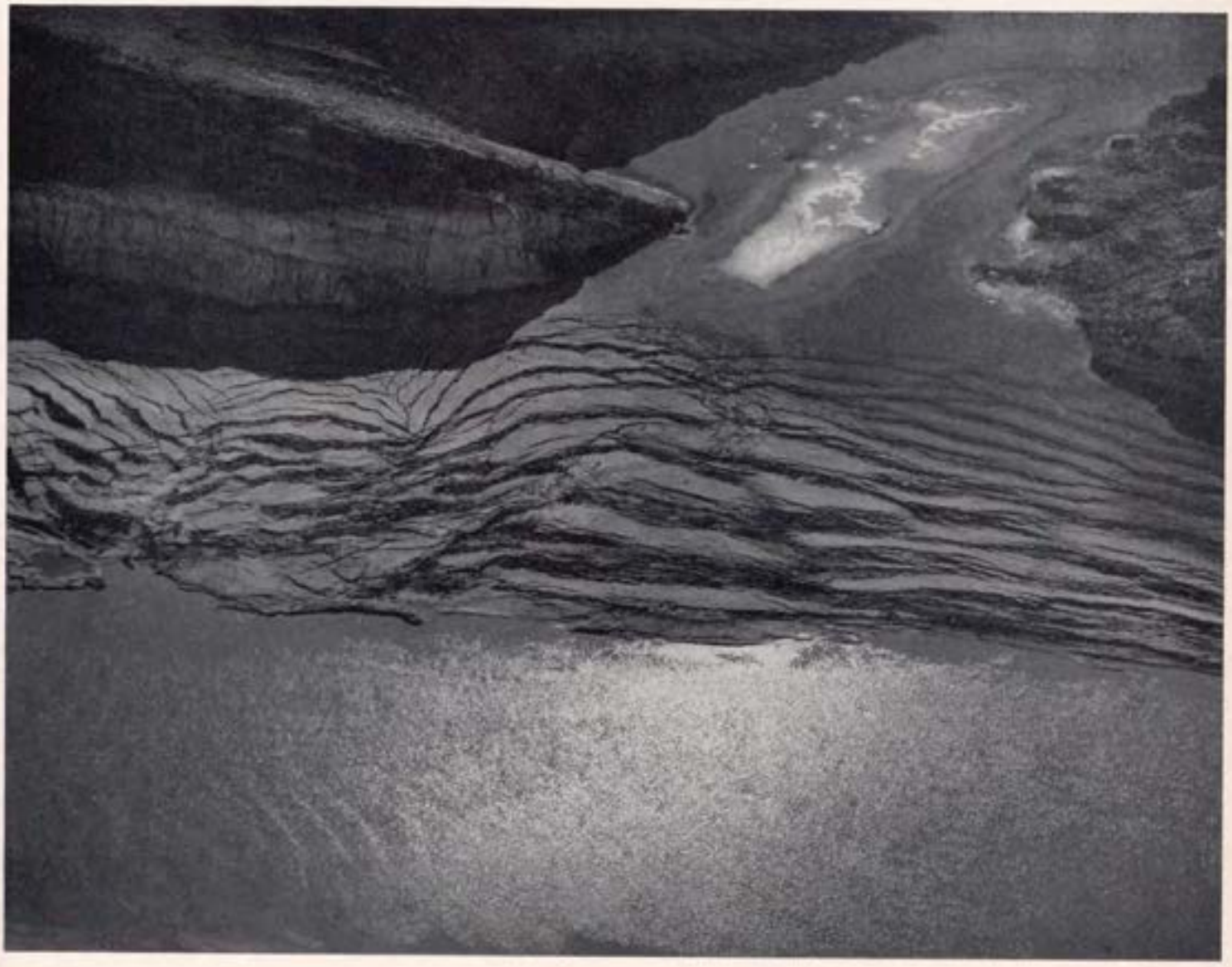


Wave action along former shorelines of Mead carved terraces around "island" stranded when the reservoir receded. Silt beds get dark color from a ground cover of tamarisk. The dambuilding Bureau of Reclamation is spending millions to eradicate tamarisk elsewhere because it is a phreatophyte, or water-loving plant. But reservoirs created by the Bureau on the Colorado are destined to become dense phreatophyte jungles. Lakelets were trapped behind silt when Mead receded. Such "bank storage" is subject to high evaporative losses, and is at least temporarily unavailable for beneficial use. Proposed reservoirs in Grand Canyon, with daily fill-and-draw-down cycles, would not lose a great deal to surface "bank storage" but might suffer from serious underground losses.

Millions of acre-feet of water that would have flowed into Lake Mead reservoir were intercepted by Glen Canyon Dam to begin filling Lake Powell reservoir, upstream from Grand Canyon. But even if this water had reached it, Mead would still have been drawn down to provide excess storage capacity for possible flood waters. Uninviting acres of caked mud are normal at the upper end of Mead, here seen near Grand Wash. Reservoirs of proposed dams in Grand Canyon would be too small for flood control, but would be drawn down daily to generate peaking power.

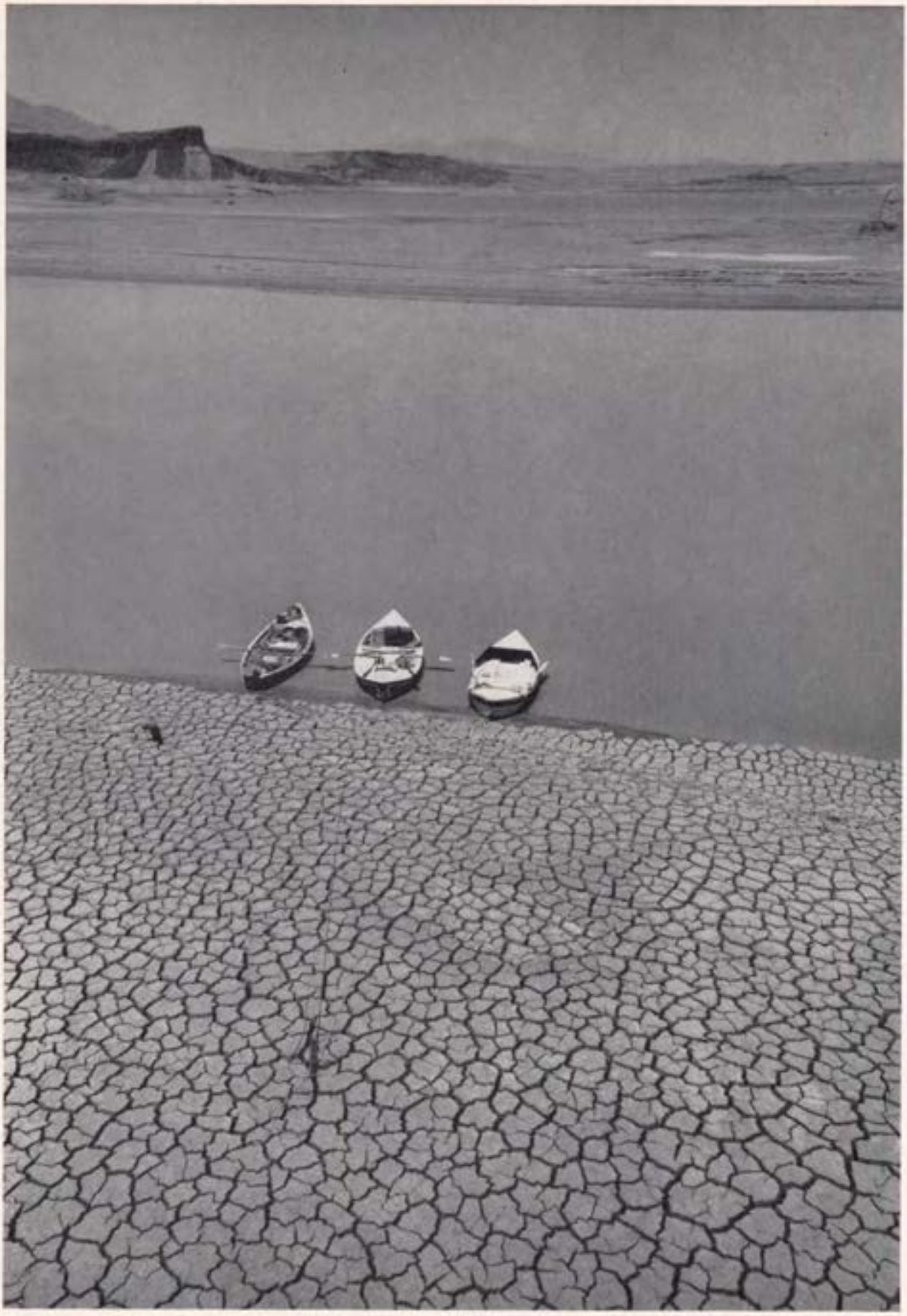
When Lake Mead reservoir retreated from the vicinity of Pierce Ferry, the Colorado, a living river again, resumed its work of leveling the land and transporting it toward the sea. In foreground, a "glacier" of muck oozes back into the river. At left center, fissures in silt beds reveal that the Colorado is busy reclaiming its own. Only in its infancy will Hoover Dam impound water; after that, its reservoir clogged with sediment, it will exist half-entombed for as many millenia as it takes the Colorado to wear the dam away and carry it, too, to the sea. During its useful life, however, Hoover Dam controls floods, stores water, regulates the river, irrigates land, and generates electricity. Shorter-lived dams proposed for Grand Canyon would have no flood control, storage, river regulation, or irrigation functions; the dams would merely generate electricity . . . for a time.

Water-borne recreation is claimed by dambuilders as a major benefit, but most boatmen shun the silty sterility of Lake Mead reservoir's upper reaches. A natural riverbank or natural lakeshore is an inviting place to picnic or explore, but this? Closer to Hoover Dam, Mead's artificiality is less disturbingly betrayed by more subtle signs. But siltation is an inexorable process, and recreational opportunities must diminish steadily until they vanish altogether. Any recreational benefits of proposed dams and reservoirs in Grand Canyon would be as evanescent as their power-producing potential, but damage done by them would persist for all man's time.



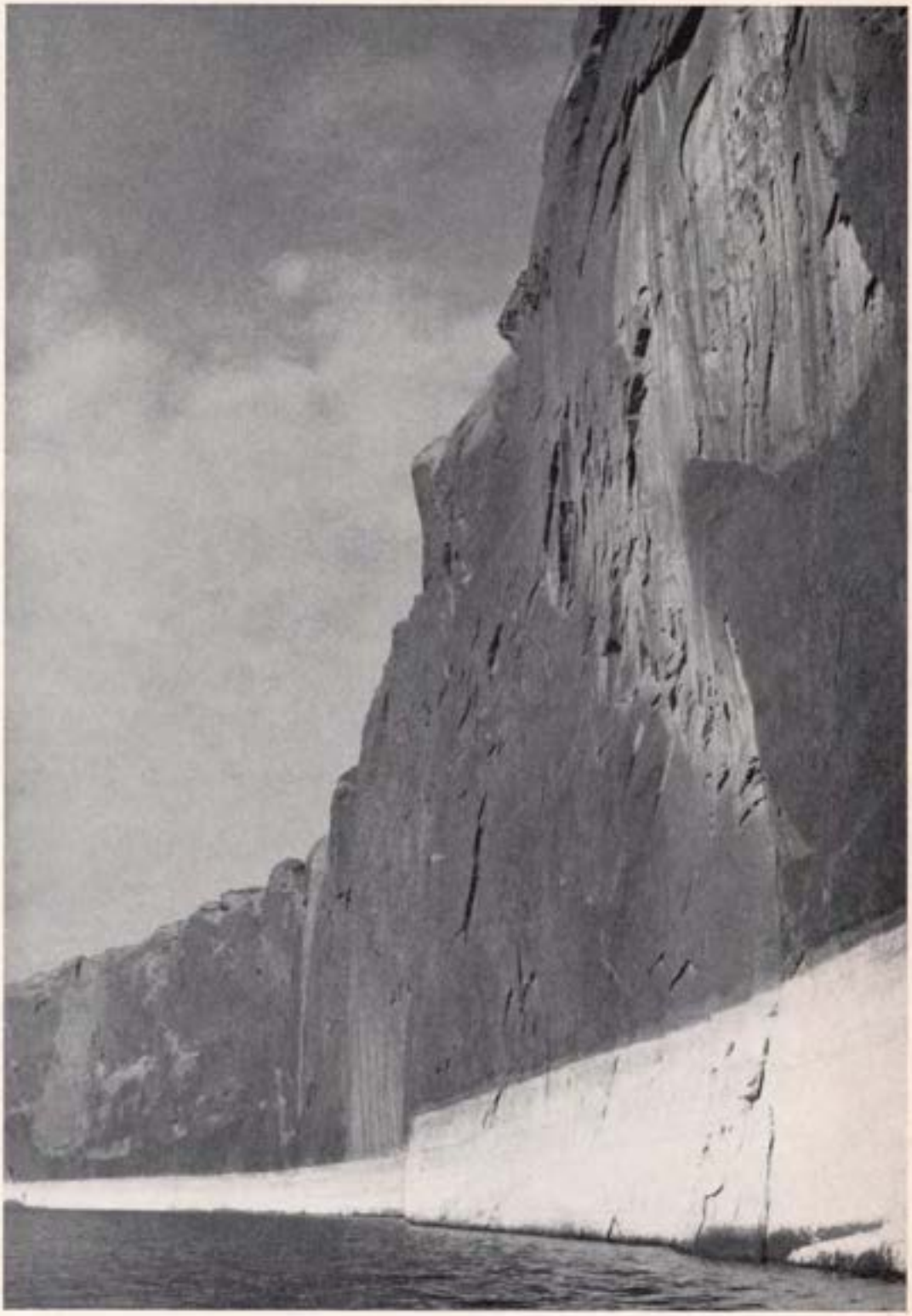
Even if Lake Mead reservoir never fills with water again, its entire basin will become choked with sediment. In fact, the basin will be filled above Mead's highwater mark because the Colorado River builds its own gradient; unable to lower its bed at Hoover Dam, it will raise its bed upstream from Hoover. If the proposed Hualapai dam were built in Grand Canyon, the same process of headward aggradation would ultimately thrust a spearhead of alluvium perhaps 15 miles upstream from the head of Hualapai reservoir—within Grand Canyon National Park. The proposed Marble Canyon dam would choke with sediment the upper 40 miles of Grand Canyon and the lower 13 miles of Glen Canyon, to the toe of Glen Canyon Dam.

Side canyons are Grand Canyon beauty spots. Emory Creek was one, until Mead reached it and receded again. Bureau of Reclamation engineers say that proposed reservoirs in Grand Canyon would fluctuate not more than ten feet. But unlike the seasonal cycling of Mead, daily fill-and-draw-down cycles would prevent any plant life from growing between high and low water. A few feet of vertical fluctuation would produce hundreds of yards of fluctuation laterally, alternately flooding and exposing acres of lifeless mudflats in side canyons and in the main canyon itself.

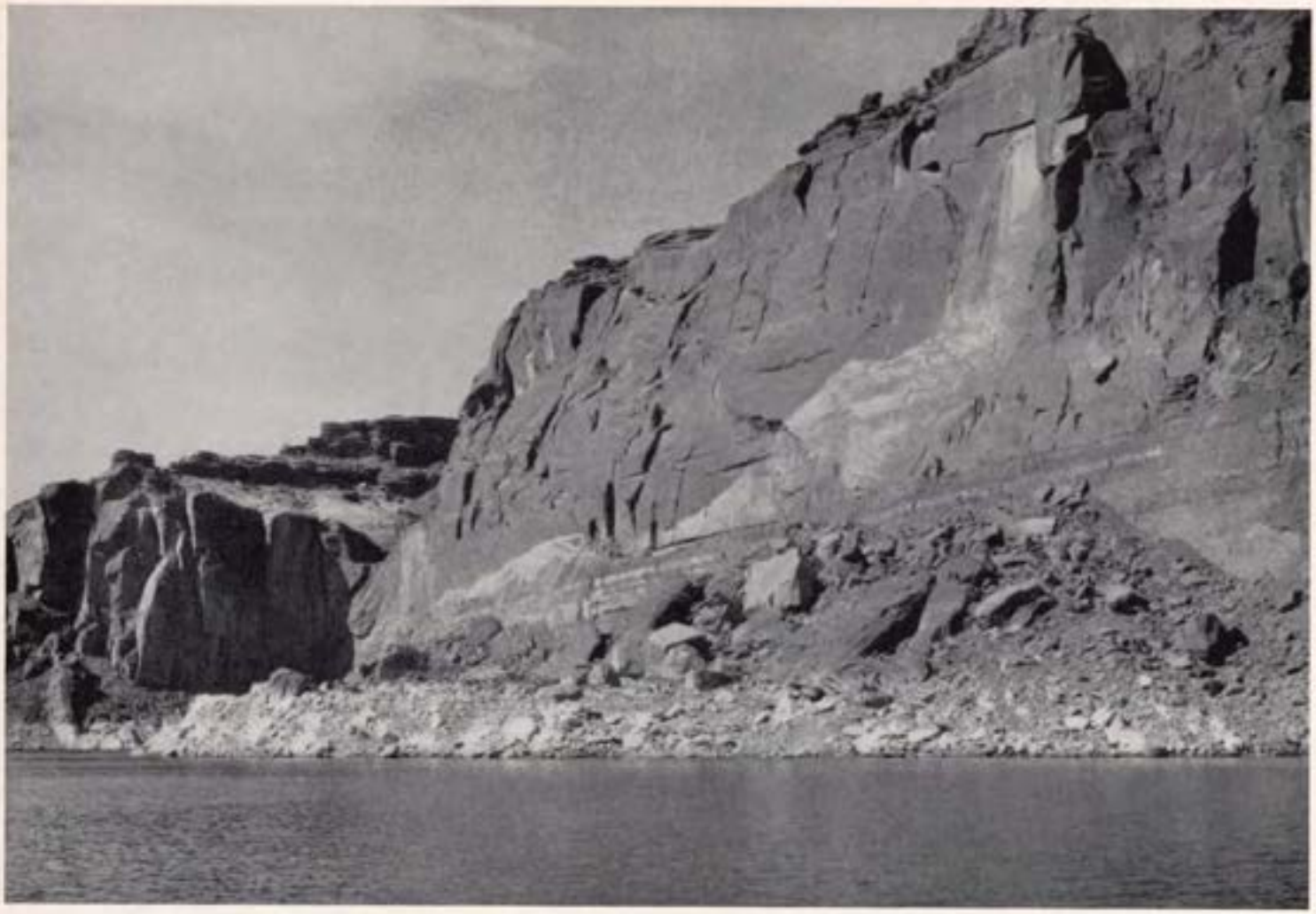


This Was Glen Canyon

PHOTOGRAPHS BY
DICK NORGAARD
AND HUGH NASH

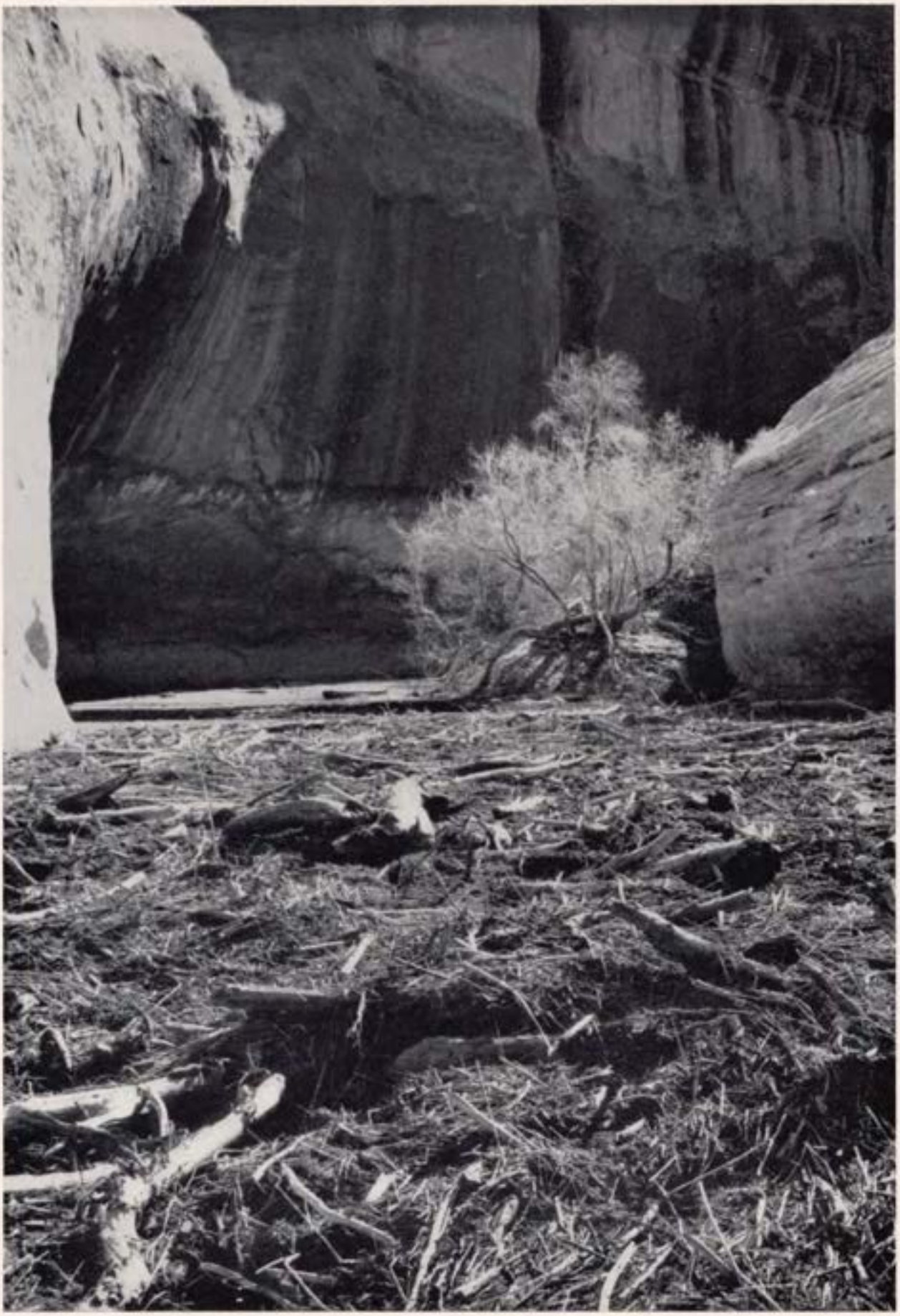


Lake Powell reservoir, Easter 1967. The reservoir had been as much as 34 feet higher, as the stripe of bleached-bones white indicates, but was drawn down for power generation at Glen Canyon Dam and for replenishment of Lake Mead reservoir, downstream. If and when Powell fills to capacity, it will rise about 200 feet higher. During daily draw-downs for peak power generation, proposed reservoirs in Grand Canyon would also be afflicted by this "ring around the bathtub" effect.

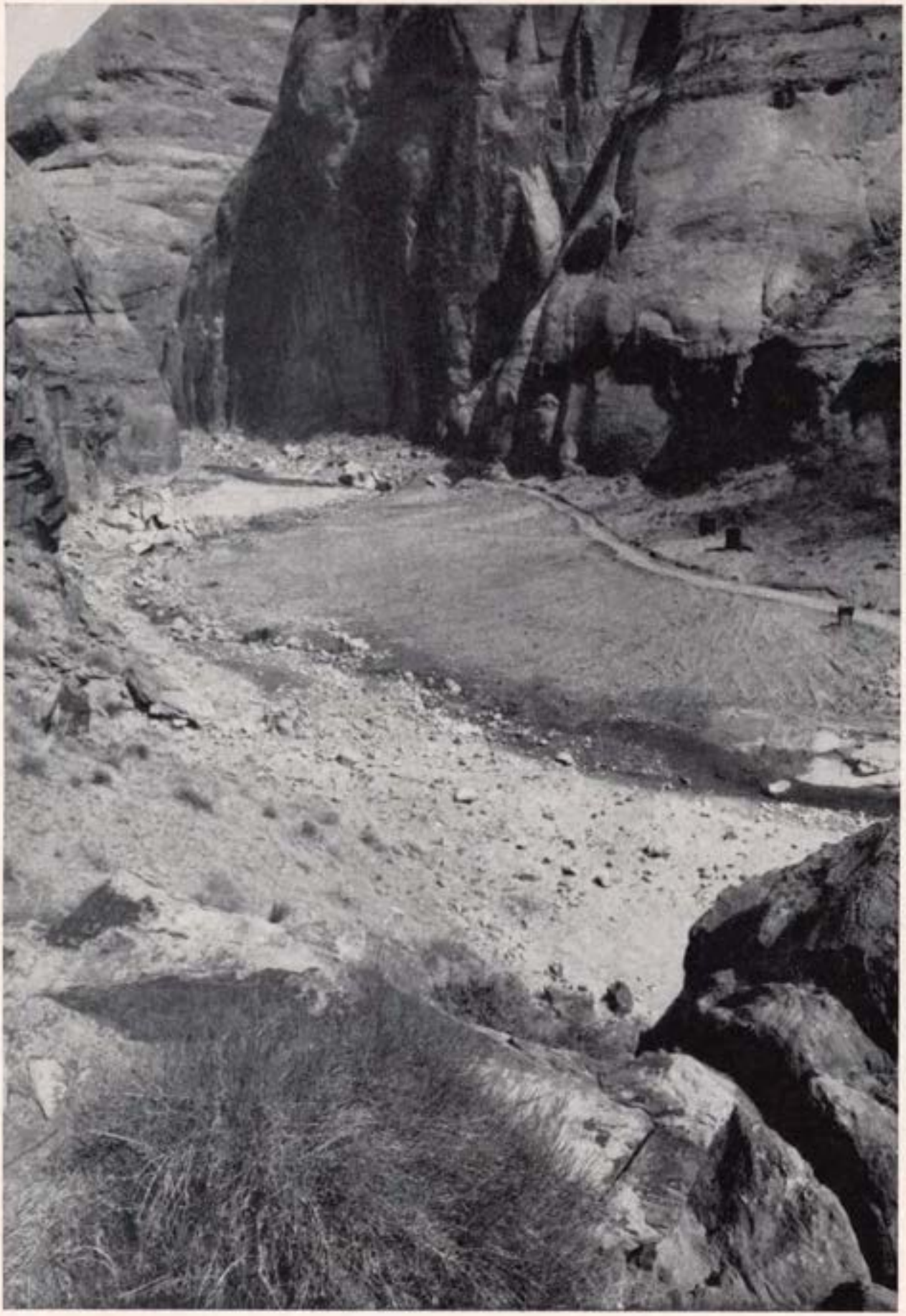


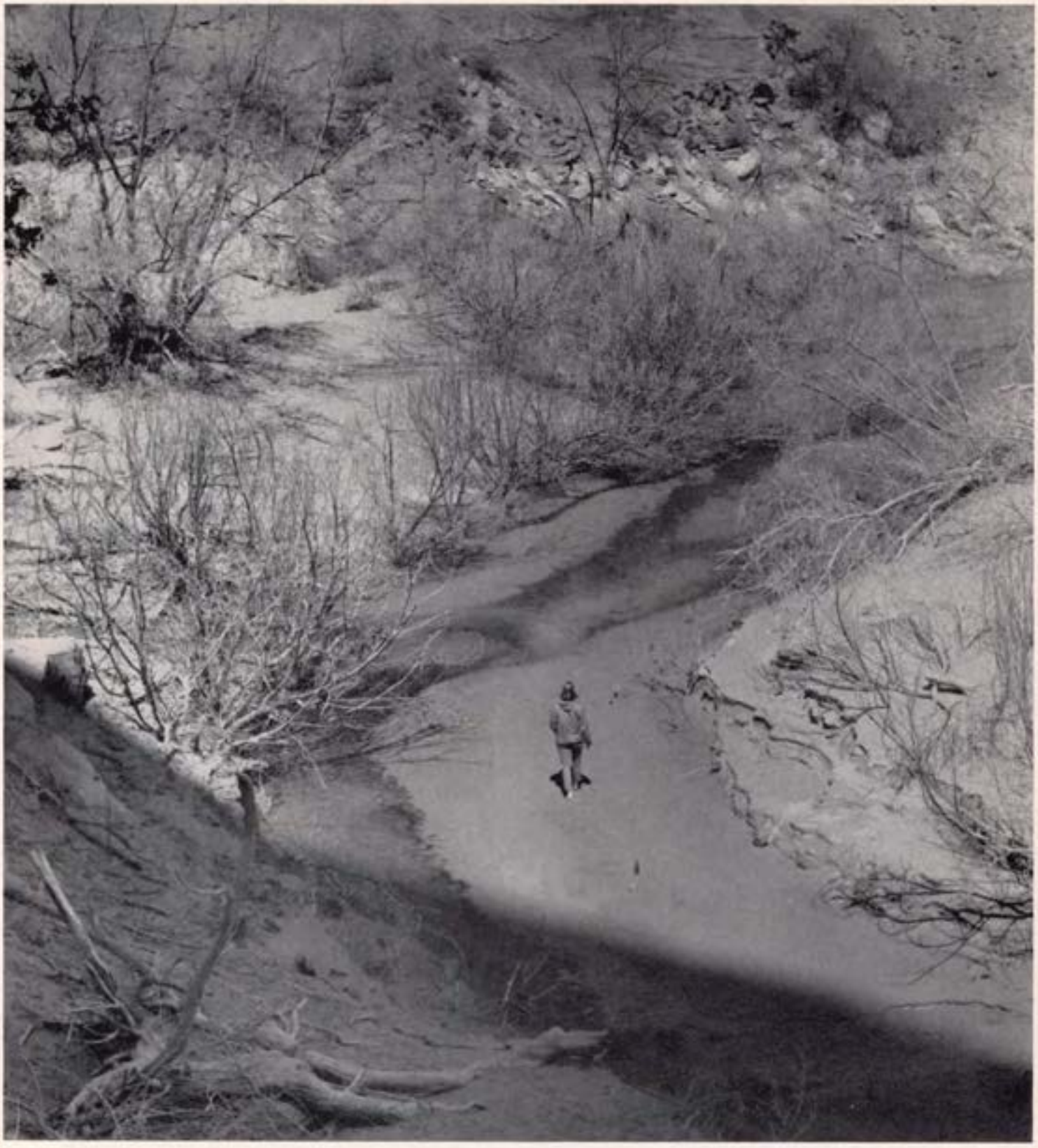
Fragments of a fallen pinnacle lie beneath the ghostly outline it left behind on the cliff it parted from. Rising waters of Lake Powell reservoir weaken the permeable rock of its basin, causing such collapses. Because the promise to protect it was dishonored, Rainbow Bridge may collapse when Powell backs water beneath it. Grand Canyon's inner gorge is full of soaring spires that would be vulnerable if proposed dams were to be built there.

Side canyons were Glen Canyon's glory. Now they look ravaged when Powell is drawn down, as it must be much of the time. Silt and debris that were formerly flushed out by sidestreams and dispersed by a living Colorado River are now merely shifted about by Powell's rise and fall. With the reservoir drawn down 34 feet from the highest level it had yet reached, it was necessary in April 1967 to push miles up devastated side canyons before reaching living streams and living greenery. Grand Canyon's glorious tributary canyons are fated to go the way of Glen Canyon's if Americans permit Marble Canyon dam or Hualapai dam to be built.



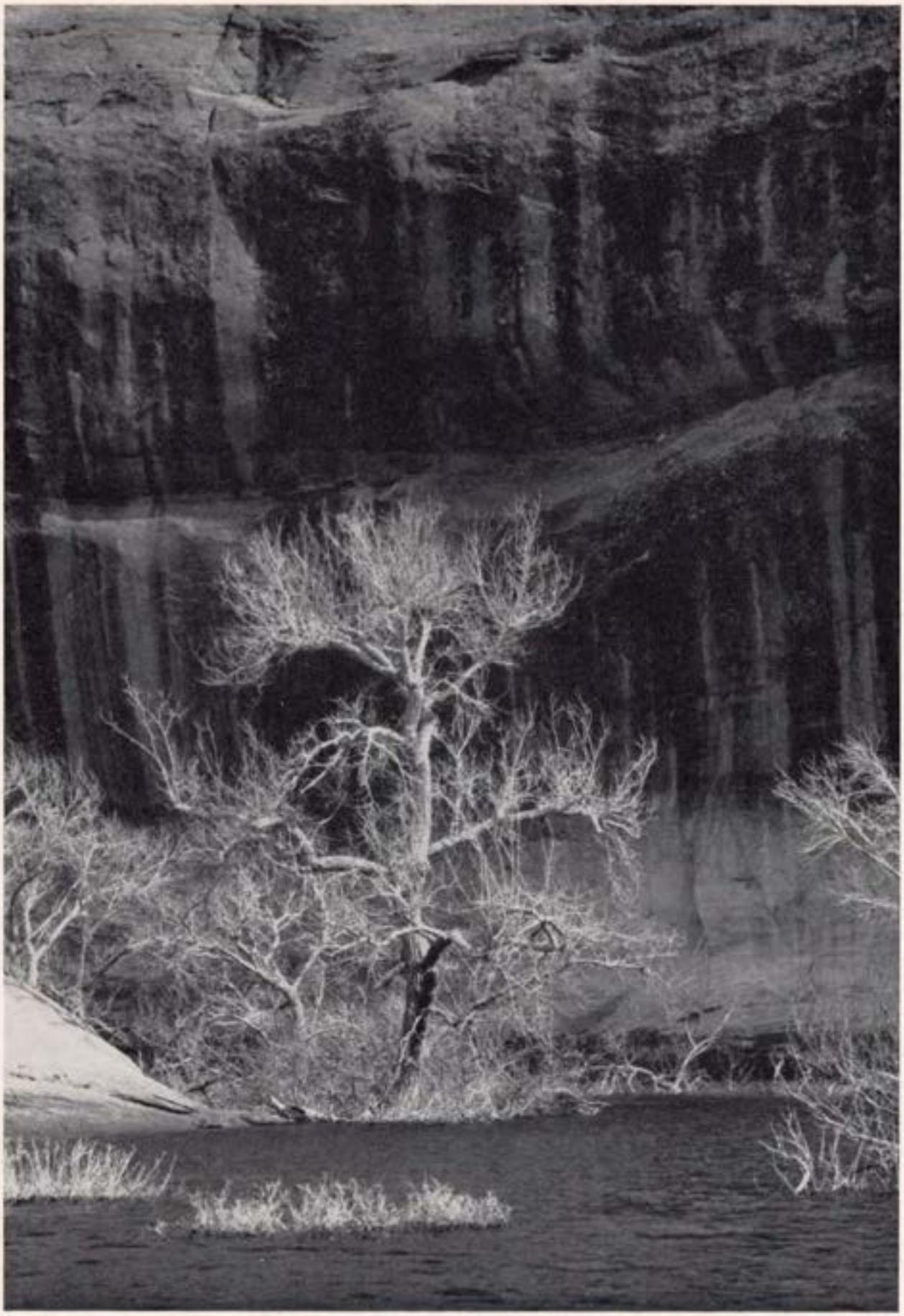
Aerial photograph shows approach to Rainbow Bridge. (The bridge is about one mile up-canyon from the present trailhead, but if filled, Lake Powell reservoir would back water under it.) When Powell was 34 feet higher, the floating dock (above and right of center) was moored at the bottom left corner of the photograph. Picture on facing page also shows Rainbow Bridge trailhead. Park Service personnel almost obliterated Bridge Creek's streambed in the course of bulldozing debris away from the formerly inundated area, then erected the sign nearby. But the Park Service is not responsible for the vastly greater "disturbance of natural features" that led to this one—the Bureau of Reclamation's Glen Canyon Dam and Lake Powell reservoir.





Drowned willows, silt, and debris marked the approach to Cathedral in the Desert when Lake Powell reservoir was drawn down 34 feet below its pre-1967 maximum. Proposed dams in Grand Canyon would drown sidestreams too, and deny access to beauty spots that were spared drowning.

Cathedral in the Desert was still one of the world's magical places on Easter Sunday, 1967. But reservoir waters had already covered its floor and receded; they are to rise almost 200 feet higher. The Cathedral's tinkling falls, its hanging garden of ferns mirrored in a plunge pool, will be gone.



150,000 tons of suspended sediment per year, not to mention bed load, then at twelve miles per hour, for the day the extraordinary flash flood excites the river that much, the Colorado *can carry in that single day 21 times as much as the 60-year-average-river carried in its average year.* This is a little hard to grasp. But grasping it helps you understand how that little stream down there a mile below you, which looks as if it had dried up in the bottom of that incredible canyon, could carve the whole works in just a few minutes, if you use eons for years, or in about 10 million years if you insist upon being conventional.

In any event, with nice columns of figures that don't check out as often as we wish they did, the Bureau of Reclamation has postulated a revenue-producing operation of dams in Grand Canyon that in the course of a century will, they pray, pay for the fraction of their projects that the nation as a whole doesn't have to pay for first. The Bureau counts on that century of operation, and puts all the money from the operation in its cash registers and sounds very cheery about it, without having the slightest assurance that the century will ever leave their dams alone and unsilted up.

In the worst case, their revenues start drying up, given a half life, about 60 years before their payout tables face the facts of silt life. In the best case—if you want to bet on it, remembering the odds that a 6th-power calculation force upon you—they fade 10 years ahead of their schedule. And all the while they assume the public will like the Bureau's hydroelectric peaking kilowatts so much better than anyone else's that they will pay the Bureau, for the very same product (to us, one kilowatt-hour looks very much like the next one), about $2 billion dollars more over the 100-year payout period than they would pay investor-owned, taxpaying utilities. Don't believe it.

But let's sum things up.

Between 60 and 160 years the four Grand Canyon dams (let's group them) will be out of action. Long before that, they will be uneconomic—even by the Bureau of Reclamation's most optimistic dreams about how well power users love the Bureau's high power rates.

But let's all assume a Rip van Winkle capability and wake up 100 years or so from today. The Bay Area Rapid Transit System is almost ready to go and New York's has rusted away. We find we have been forgiven for our faults in handling transportation, but not for letting them dam the Grand Canyon.

The reservoirs are gone now, though; they are full of sediment and nearly out of action. There are no equivalent damsites left on the Colorado because we have used the best. There are far more people, needing far more than we do the residue we left them of the earth's treasures after we had first grabs. But they will have to do without anything but the dregs of Colorado damsites.

The best of the scenery is gone, too. It has been replaced, in the Grand Canyon area, by some 200,000 acres of phreatophyte jungle. You don't like asphalt jungles too well; these you will like less, and ask the man who bemoans one. Or even ask the Bureau of Reclamation, an agency that hates phreatophytes so much that it has a major program afoot to eradicate 42,000 acres of the jungle so as to save 100,000 acre-feet of water per year. While tooling up to eradicate the 42,000, the Bureau will create another 200,000. And still another 200,000 or so up where Lake Powell was, in from 200–300 years.

Remember those figures. 2 plus 2 equals 400,000 acres of wall-to-wall sediment, topped with that jungle. The evaporation index in this country is about 6–8 feet per year, to which the extra efficiency in evapo-transpiration phreatophytes (saltcedar or tamarisk, cottonwoods, willows, and other pleasant bits of green you find along desert water courses) are capable of. Round it to 10 feet of evaporation per acre per year to help the arithmetic, and you find that the Bureau of Reclamation has planned a river-development scheme, and now wants to round it out, that will evaporate, beyond anyone's use, 4,000,000 acre-feet of water per year (5,000,000 if you include Lake Mead and more if you include its aggraded expanse and throw in Parker and Davis dams, too) on a river that was going to give them only 7.5 million acre feet. That doesn't even leave enough for California, and isn't it too bad about the other Colorado Basin states.

Charge it all to river planning, and especially to the idea that if you are to have any water at all, you must dam it and evaporate it so as to produce hydroelectric power. You must, you see, because here, in the year 1967, with the atom and its energy known for a quarter of a century, we have a Bureau that only knows how to make hydropower, and has the political power to go on insisting on doing, on preëmpting, what progressive people, agencies, and bureaus can do better.

And all this, to add Ossa on Pelion, stemming from the idea that man can do without unspoiled nature, especially such unspoiled nature as remains in the Grand Canyon. He can do without nature so well that he must continue loading more of his kind on this planet. So many more that within the century even his self-impoverished earth won't sustain him.

P.S. There is one minor item not quite to be ignored: bank "storage." This is a bank that issues many deposit slips, but very few for withdrawals.

As Lake Powell began to fill, the Bureau was chagrined to learn that the prediction of 15 per cent loss to bank storage had risen to 33 per cent, with the reservoir only one-third full (and now dropping). Three years, now, Lake Powell has been trying to get full. The maximum capacity reached was about 9,000,000 acre-feet, one-third of the potential. To get that 9,000,000 with a one-third bank-storage loss, 14,000,000 had to flow in, counting the 1,000,000 lost in the interim to evaporation. That makes 5,000,000 acre-feet beyond recall in three years. Don't let anyone fool you into thinking you can get it back. It's gone, into

the wild dark yonder of the desert's understory, which hasn't given forth much water for a long time.

That's just the beginning at Lake Powell. One wild rumor (we hope it's wild, that is) would have 80,000,000 acre-feet of much-needed water disappearing into the great beyond of bank storage when the lake is full. Some will trickle back as the Reclamation Bureau pulls the reservoir back down 221 feet from time to time. This the Bureau must do, exposing about 100,000 acres or so of badly damaged lake edge, if the Bureau operates Lake Powell as it said it must. When the reservoir is pulled down that 221 feet, some bank storage will flow back into the Colorado Basin. Much of it, oozing out in seeps on desert-hot rock, will vaporize; but some will get to Los Angeles and Phoenix. Not much to Tucson.

For a while, that is.

But then the lake will fulfill its destiny. The Colorado will fill it full, that is, with sediment. At that point in time, whatever got away into bank storage cannot return when the reservoir gets pulled down because there will be no more pulling down. Quite the opposite. Headward aggradation will build the ramps that can spill still more precious waters into that wild, bank-storage *beyond*.

So much for Lake Powell, a bad enough beginning. When you take what the aggraded Coconino silt-retention reservoir can do, in addition to impairing, unauthorized, a substantial area on the Navajo Reservation, you will find that it is quite possible that the Bureau's Coconino silt trap will be capable of evaporating *all* the flow of the Little Colorado. Add the gross losses in bank storage as Coconino silts up. Do the same for the Paria silt trap, for the Marble Canyon silt trap, for the Bridge Canyon (Hualapai) silt trap, and then remember that Lake Mead's day will come, and Lakes Havasu and Mojave's not far behind.

Add the acreages up. Glen, 200,000; the Grand Canyon foursome, another 200,000; Mead, duly aggraded, with Havasu and Mojave similarly favored, and the Bureau's few upstream devices, Flaming Gorge, Curecanti, Granby, Navajo, and ancillary reservoir attractions. Round those all off at a conservative 100,000. Call it all, for easy rounding, 500,000 acres, all of it quite impressive in its phreatophyte expanse, evaporating that average 10 feet per year, and losing in bank storage, and permanently, something like 40 per cent of the total storage capacity.

Multiply this all by the 100-year cost-benefit period the Bureau now likes to use. And see what we have taken away from the generations that will have a harder time making out with the earth than we do—all at a cost to ourselves and them of five to ten billion dollars.

Or perhaps the people would like to give the whole proposition a harder look, insisting that man's inertia be used less and his genius more. Perhaps there's a moral: Grand Canyon is a place to stop, look, and always have a river to listen to—240 miles of river, all of it alive.

The foregoing is adapted from testimony presented in March 1967 before the House Committee on Interior and Insular Affairs, whose Chairman, Wayne Aspinall, asked the Bureau of Reclamation for an appraisal of it. Commissioner Floyd Dominy's report follows.

U.S. Department of the Interior,
Bureau of Reclamation,
Washington, D.C., April 3, 1967

Hon. Wayne N. Aspinall,
Chairman, Committee on Interior and Insular Affairs,
House of Representatives, Washington, D.C.

Dear Mr. Chairman: Your letter of March 20 requested that we review Mr. David Brower's statement on the sediment problem of the Colorado River which he presented during the recent hearings on Colorado River legislation.

Mr. Brower's semi-facetious "Sedimental Journey" is similar to most of his other statements, advertisements, books, etc., in that it is designed to appeal to public emotion with too little attention to fact. Where facts do enter into the statement they are, for the most part, distorted, misapplied, and buttressed with unfounded assumptions, rumors, and oblique references to unnamed experts. The net result is a mish-mash of fact and fancy leading to completely erroneous conclusions which no responsible hydrologist could support.

For example, he states that "nowhere do we have a reliable estimate, or more than detached pieces of estimate so far removed as not to fit together, of what the all-important sedimentation rates really are." The facts are that records of sediment flow on the Colorado River are among the best, if not the best, of any major river in the country. In some instances they go back as far as 1926. The most valuable and complete record, as far as reservoir sediment deposition is concerned, is that for Lake Mead, where three separate sediment surveys have been made which provide an accurate historical record of actual sediment accumulation over a 30-year period.

Another absurdity in Mr. Brower's statement is his allegation that there is a 3,600-percent error factor between information on the surface area of the proposed Coconino Reservoir, as shown on maps and tables in the same Reclamation report. To reach this startling conclusion, Mr. Brower scaled reservoir areas, as shown on a location map, and compared them with corresponding areas as indicated in the report tables.

Any person possessing ordinary common sense and a desire for true facts would realize that project features on location maps are not drawn to scale; rather, they are presented generally to show relative importance. If they did

not understand this, they certainly would have inquired as to what caused a 3,600-percent error, rather than blandly stating it as an accepted fact as Mr. Brower did in his testimony before your committee. We are not perfect, but this is the first time we have been charged with being 3,600 percent wrong.

As another example, he postulates future water losses in the magnitude of 3,000,000 to 4,000,000 acre-feet per year resulting from what he terms as phreatophyte jungles that he envisions will spring up in the reservoir areas of proposed dams. Typical of his reasoning to reach such alarming figures, he conjures up a 150,000-acre silt trap and phreatophyte jungle behind Coconino Dam on the Little Colorado River that will cost the Colorado Basin an annual loss of 1,500,000 acre-feet through evaporation and transpiration. He doesn't explain how it is possible to lose 1,500,000 acre-feet of water annually from a stream with an annual runoff of less than 200,000 acre-feet.

Further, Mr. Brower recognizes that Lake Powell will act as a huge sediment trap but then apparently ignores this in his calculations of the projected life of Hualapai Reservoir.

Rather than attempt to make reason out of Mr. Brower's labored distortions, we believe it would be simpler and more understandable to provide an up-to-date statement on our sediment studies and their relation to existing and proposed projects on the Colorado River. The statement is attached. We hope it will be useful to your committee.

Sincerely yours,

FLOYD E. DOMINY, *Commissioner.*

[Enclosure]

SEDIMENT RECORDS, ANALYSES, AND PROJECTIONS, COLORADO RIVER BASIN PROJECT

A great deal of information on sediment flows of the Colorado River and its tributaries between Lees Ferry and Lake Mead has been accumulated over the past 40 years. Included are three sediment surveys of Lake Mead completed in 1935, 1948, and 1964, which measure accurately the actual sediment deposition in Lake Mead over the period covered.

Available records of sediment flow

Records of the suspended sediment load of the Colorado River and its tributories are maintained by the U.S. Geological Survey and available at several points between Lees Ferry and Lake Mead, for varying periods as follows:

Station and period of record	*Years*
Colorado River at Lees Ferry, 1929–33; 1943–44; and 1948–65	25
Paria River at Lees Ferry, 1948–65	18
Little Colorado River at Cameron, 1957–65	9
Colorado River at Grand Canyon, 1926–66	41
Virgin River at Littlefield, 1948–66	19
Sediment Survey of Lake Mead, 1935, 1948, and 1964	30

Discharge and sediment records of Colorado River at Lees Ferry

The 25-year period of record shows an average water discharge of about 10.7 million acre-feet and an average suspended sediment load of about 83 million tons. Assuming that sediment weighs 65 pounds per cubic foot, the average annual sediment flow in this period was equivalent to 59,000 acre-feet per year.

Starting in 1959, however, the records are not representative of sediment inflow into Lake Powell. In 1959 the storage back of the cofferdam was filled, and in 1963 the diversion tunnel was closed and storage initiated. Some sediment was deposited in Lake Powell in these recent years. For the 18 years of record at Lees Ferry which were not affected by sediment deposition in Lake Powell, the average annual water discharge was about 12 million acre-feet and the average annual suspended sediment load about 107 million tons, or about 75,000 acre-feet per year.

Historic rates of sediment discharge on the tributaries

The following table summarizes the historical information (averages) on water discharges and suspended sediment loads on the three tributaries:

		Average annual discharges in period of sediment record		
	Years of record of sediment	*Water 1,000 Acre-feet*	*Million tons*	*Sediment 1,000 Acre-feet*
River				
Paria at Lees Ferry	18	18	3.54	2.5
Little Colorado at Cameron	9	141	9.44	6.7
Virgin at Littlefield	19	131	2.39	1.7

The long-time average water flows of these streams are somewhat greater than the flows indicated for the period of record of sediment. From a study of the relationships between annual water flow and annual sediment flow, the long time average annual sediment discharges are estimated to be about as follows:

	Acre-feet
Paria River at Lees Ferry	4,000
Little Colorado at Cameron	10,000
Virgin at Littlefield	2,500

Colorado River at Grand Canyon

For the 18 years of concurrent record at Lees Ferry and Grand Canyon, the average annual water discharge at Grand Canyon was about 12.3 million acre-feet and the average annual suspended sediment load was about 135 million tons. The average annual equivalent volume of sediment in this period is estimated to be about 95,000 acre-feet.

Sediment deposition at Lake Mead

Storage was initiated at Lake Mead in February 1935. To check the amount of sediment deposition the reservoir was surveyed in that year and resurveyed in 1948 and again

in 1964. These surveys show the following average annual rates of sedimentation:

	Years	Acre-feet per year average
1935–48	13.7	104,000
1949–64	16	80,750
Total 1935–64	29.7	91,450

During the years 1935–1964, the average annual sediment flow passing the Grand Canyon station was about 73,000 acre-feet, or about 80 percent of the sediment deposition in Lake Mead in this period.

Estimate of future sediment flow at Hualapai damsite

On the basis of the historic records presented herein, and with allowances for the effects of Lake Powell in storing the sediment flow of the Colorado River at that point, the future average annual sediment inflow initially to the Hualapai reservoir site is estimated to be as follows:

	Acre-feet
(a) Without sediment barrier dams on tributaries	25,000
(b) With sediment barrier dams on Paria and Little Colorado Rivers	16,500

Useful life of Hualapai Reservoir

The reservoir, recommended in several of the bills now pending before the Congress, has a total surface storage capacity of about 3.7 million acre-feet. If we assume 100 percent trap efficiency, but with the capability of flushing 10 percent of sediment from the reservoir, the time required to fill this space with sediment is estimated to be as follows:

	Years
(a) Without sediment barrier dams on the tributaries	163
(b) With sediment barrier dams on Paria and Little Colorado Rivers	250

Delta deposit at head of Hualapai Reservoir

The Colorado River Canyon is steep and narrow and there is no space for the buildup of a sediment jungle in the backwater. A reservoir at this site will probably cause some deposition of sediment in the river channel upstream from the reservoir pool, but this will be in the bottom of the river and the riverbed will progressively increase in elevation. However, it will still appear as a river.

To paraphrase the late Howard Zahniser, we admire the ardor with which Mr. Dominy singles out our emotionalism. It is hard not to comment that if the Colorado sediment records are among the best, the Bureau has a long way to go. As Senator Clinton Anderson has pointed out, the Bureau's water-flow records lean toward the wet-year cycles. The sediment-flow records are skewed by a preponderance of dry years. One would expect wet years to carry more freight.

We can all be pleased that the 3600% error is an overstatement. It would have been helpful if Mr. Dominy had supplied Mr. Aspinall with the accurate figure.

We are grateful for Mr. Dominy's pointing out our error and letting us see what the flow of the Little Colorado actually is. We should have gladly corrected our statement before placing it in the record if Mr. Dominy had let us know where we erred. A copy of "Sedimental Journey" was in the Bureau's hands for nine months before Mr. Dominy wrote Mr. Aspinall, and the public did not know what he wrote until the hearings were published.

But despite the more or less good-humored exchange—and Mr. Dominy and we still exchange friendly greetings at hearings — the Bureau has not yet pulled its silt story out of the mire.

Commissioner Dominy once said Lake Powell would never silt up, and said in a less exuberant mood that Lake Mead would live 500 years. To fill Mead in five centuries would take an average of 54,000 acre-feet of sediment per year. This sedimentation rate would fill Marble reservoir in less than seven years, Bridge reservoir in less than 70. The Glen Canyon, Paria, and Coconino silt traps would keep the yearly accumulation below the 54,000 acre-feet average—while they lived. After they choked themselves, far more than 54,000 acre-feet per year would spill over and around them. How confident are we entitled to be that we know when that day would come, and that dams in Grand Canyon would pay for themselves before their protection ran out?

If records of sediment flow in the Colorado are as good as Commissioner Dominy says they are, why can't his Bureau justify more convincingly its estimates of reservoir and silt trap longevity? Why doesn't the Bureau share its data, state its assumptions, and show step by step how it reaches its conclusions? Instead of simply asserting that Mead will last 500 years and Powell will last forever, why can't Commissioner Dominy show us his Bureau's arithmetic?

We don't pretend to have all the answers on sedimentation. We don't believe the Bureau of Reclamation has enough answers either, or that it is looking hard enough. Until it has, it is irresponsible to think of spending a billion dollars in Grand Canyon at the Canyon's expense.

In his power to alter the face of the only earth he has to live on, man has become a geological force. Unless this power is tempered with responsibility, how is it better than storm, earthquake, drought and flood? Humans can do better. —D.B.

Some gift horsepower that needs to be looked in the mouth it, by a nuclear engineer

The Great Grand Canyon Subsidy Machine

LAURENCE I. MOSS

IN THE AMERICAN WEST of 1849 the preoccupation of the day was the search for gold. In the West of today, the search is for a very special kind of water. Although it looks the same, tastes the same, and feels the same as ordinary water, this water is different. It is subsidized water, the full cost of which need not be paid by the user. The search for subsidized water led a small group of men, the "water leaders" of the seven Colorado Basin states—with the help of the Bureau of Reclamation of the U.S. Department of the Interior—to the conclusion that the Grand Canyon must be dammed.

These architects of water policy and planning fashioned a document that became known, in the form in which it was submitted in 1966 for the approval of Congress, as H.R. 4671. The various provisions of H.R. 4671 give a classic example of the lengths (some might say depths) to which the people who now formulate water policy are willing to go in their pursuit of subsidized water.

Why can't the people who use water pay the full cost of delivering it to them? More than 99 per cent of the people can, and usually do. These are the users of water for municipal and industrial purposes. The users of water for agriculture, however, say that they cannot afford to pay the full cost—and in the Colorado Basin states, they use more than 90 per cent of all the water. If it is granted that subsidizing irrigation agriculture is of social value, it still remains necessary to scrutinize the efficiency of the methods.

How to Subsidize Water

The ways of subsidizing water are many. Four favorite methods are as follows:

1. Charge municipal and industrial water users more than the cost of delivering water to them, and use the difference to help subsidize agricultural water users. In H.R. 4671 it was proposed that municipal and industrial water be sold for $50 per acre-foot and agricultural water for $10.

2. Get the federal government to pay for a portion of the project with funds that need not be repaid. In H.R. 4671, $83 million of the costs were assigned to "recreation, fish, and wildlife" and were therefore non-reimbursable. Beyond that, H.R. 4671 set the stage for a multibillion-dollar grant of nonreimbursable funds for a massive importation of water from—presumably—the Columbia River. This was done by having the federal government assume the obligation—previously an obligation of the Colorado River Basin states—to deliver 1.5 million acre-feet of Colorado River water per year to Mexico. This would become a national obligation as soon as water began to be imported into the basin. H.R. 4671 also sought to establish the precedent that a state seeking to expand the capacity of an aqueduct need pay only the incremental costs of the expansion.

The scenario is thus quite clear, though a bit expensive for the average U.S. taxpayer. At some future date it will be proposed that the federal government build an aqueduct to transport 2.5 million acre-feet of water per year from the Columbia River to the Colorado River to satisfy the national obligation: 1.5 million acre-feet for Mexico plus one million acre-feet for losses from evaporation and seepage along the way (including losses from existing reservoirs) gives 2.5 million acre-feet. This project would qualify for nonreimbursable funds. Representatives of the Colorado Basin states would then come along and say: "Since you are building all those dams, reservoirs, tunnels, canals, and pumping stations, and since we would like about six million acre-feet of Columbia River water for ourselves, let's put a few more pumps in the pumping stations and widen the canals and tunnels a bit to handle the extra water. We will be glad to pay the incremental costs." The net result is that the Colorado Basin states would get 80 per cent of the delivered water and the federal government would pay most of the costs. These costs have been estimated to be about $10 billion.

3. Borrow, at interest rates subsidized by the federal government, what the federal government won't give you outright. Money for the costs of facilities to supply irrigation water can be borrowed from the U.S. Treasury interest-free. Money for the costs of other facilities, such as hydropower dams, can be borrowed at interest rates (3.2 per

cent) that are, at least at the present time, much less than the Treasury's cost of borrowing money (about 5 per cent). This is because the formula used to determine the interest rate does not average the costs to the Treasury of all money; it considers only long-term obligations. When interest rates are high the Treasury finances its operations with short-term obligations, and the costs of these borrowings never appear in the formula.

4. Build a subsidy machine. A subsidy machine is a physical object that, to the casual observer, is capable of making money. Its actual role is to divert money from the U.S. Treasury to another bank account while giving the appearance that the money is being earned. Two subsidy machines were proposed in H.R. 4671. These were the two hydropower dams to be built in the Grand Canyon: Bridge Canyon Dam (now called Hualapai Dam) and Marble Canyon Dam. These dams would not provide anyone with water.

Nuclear and Hydro Power Costs

Item 4 deserves further comment. In the past, power from dams could be generated and delivered at lower cost than with steam plant alternatives. In most areas of the United States this no longer is the case. A historic reversal of the relative costs of hydro versus steam plant power has occurred. The prior commitment of many of the most desirable hydropower sites, the gradual increase in the costs of heavy construction, and the imminent large-scale introduction of low-cost nuclear power have accomplished this reversal.

In 1965 about 30 per cent of all of the steam plant generating capacity ordered by utilities was for nuclear plants. In 1966 more than 50 per cent was nuclear. In 1967 the percentage will be even higher; sales of nuclear plants in the first seven months of the year have equalled the sales for the entire year of 1966.

The total generating capacity of the nuclear plants ordered in just these two and one-half years is about 25 times the combined capacity of the two proposed Grand Canyon dams. The at-plant costs of power from most of these nuclear plants will range from about 3.5 to 4.4 mills per kilowatt-hour under conditions of financing by investor-owned utilities—which, primarily because they must pay taxes, have typical capital charge rates of 12 per cent—to 2.4 to 2.8 mills per kilowatt-hour with financing by public agencies such as TVA, with typical capital charge rates of 6 per cent. These costs are based on complete amortization of the plant in a 30–35-year period. Since the costs of nuclear plants are relatively independent of location, they can be better situated with respect to load centers, and transmission costs will be very much less than for hydropower dams.

Generation of Peaking Power

"Peaking power" is power generated during those hours of the week when the demand for electricity is high. It can be supplied by either hydro or steam plants operated only during these high-demand hours.

Nuclear plants are generally not now being used to meet peaking power requirements. The reason, paradoxically, is that the production costs of electrical energy from the new nuclear plants are the lowest of any steam plants on the system of the typical utility. The utility thus chooses to shut down the higher cost producers (the coal-fired, oil-fired, and gas-fired plants) when the demand for power drops. So far as possible the nuclear plants are operated continuously.

There is no technical reason why nuclear plants cannot be operated to meet the same peaking power requirements as hydropower dams are at present designed to meet. A moment's reflection on the operation of nuclear reactors in submarines should dispel any doubts. Twenty years from now, when a large fraction of installed capacity will be nuclear, in all probability some of the nuclear plants—the older, less efficient ones—will be so operated.

Hydropower installations designed for peaking power operation cannot operate continuously over a long period of time. The reason is that the water turbines are sized to use all the river's average annual flow when operating only about 20–45 per cent of the time. Beyond that, there is no additional water to run through the turbines to generate power.

Because nuclear plants have no such limitation they can provide savings not only during peak demand hours but also during off-peak hours by displacing higher production cost coal-fired, oil-fired, and gas-fired steam plants. That is to say, it is preferable to operate the new nuclear plants continuously and relegate some of the older fossil fuel plants to operation during peaking power hours. The end result, in terms of system generation, is the same as if new plants, either nuclear or hydro, were operated for peaking power alone and the operation of the fossil-fuel units was not changed, but the overall system production costs are very much less.

The Factor of System Reliability

It is perhaps appropriate to comment at this juncture that thermal generation, either nuclear or fossil fuel, is well suited to meeting all peaking power and reserve requirements. Proponents of hydropower projects, when their projects have been shown not to be economically justified, have a propensity to wax eloquent over the supposed unique virtues of hydropower as compared with the supposed sins of thermal generation. Their acceptance of hydropower, regardless of cost, has a quality bordering on that of mystical revelation.

These proponents are welcome to their illusions. The facts, however, are as expressed by Philip Sporn, chairman of the System Development Committee, American Electric Power Company, in remarks presented to the New York Society of Security Analysts on April 20, 1966. In commenting on the cause and remedy for the northeast power blackout, Mr. Sporn said:

"The first statement was made by a major utility execu-

tive. He said, 'What it boils down to is this: thermal units cannot respond quickly enough to sudden load demands, such as occurred on November 9th, to avoid a power failure. Nor can they be restarted as quickly as hydroelectric plants, should they shut down the power. This—as we found out the hard way on November 9th—is by no means satisfactory!'

"Now, my answer to this, and it's not an off-the-cuff answer, is that this is just not so. It's a complete misstatement of the facts. A well-designed thermal system, operated so that the spinning reserve is properly distributed in the generating units at all times, and that is adequately interconnected with its neighboring systems can—and by experience has proven so—be wholly reliable and capable of withstanding all manner of disturbances. It is not necessary to create uneconomic sources of hydropower in order to achieve a high degree of reliability.

"This doesn't mean that hydro capacity cannot or should not be used, if it's economically sound. The two largest cities of the United States—everybody knows which they are—have for a period of 83 years in one case, and close to that in the other (I don't know when the other city really started its electric service, but it cannot have been more than a year or two after 1882) managed to give a high quality of service without any other generation in their system except thermal.

"To condemn thermal generation after that sort of a record is to me unthinkable."

Economics of the Grand Canyon Dams

In the specific case of the proposed $750 million Grand Canyon dams, the delivered cost of power, according to figures presented by the Bureau of Reclamation, would be 5.5 mills per kilowatt-hour. The Bureau's cost estimates were made in 1963. If up-to-date estimates have been prepared they have not been reported. It is worth noting that the estimated cost of California's State Water Project has jumped nearly $800 million in the same time period, from the $2.053 billion given in the Department of Water Resources Bulletin 132-63 (issued in 1963) to $2.814 billion given in Bulletin 132-67 (issued in 1967). By no means all of this 37% increase can be attributed to an increase in project yield. The Bureau of Reclamation's calculations, based on a total initial cost of $750 million, should therefore be regarded as optimistic.

The same must be said of the Bureau's revenue projections, since they are based on the sale of power for the first 100 years of operation at a price of 6.0 mills per kilowatt-hour. Accepting these figures for the moment, and calculating the net revenue from the difference between selling price and cost, gives a total of $3.5 million per year from both dams during the initial 50-year pay-out period. Parenthetically, it should be noted that the initial cost of the initial subsidy for the dams, provided by the U.S. Treasury, would be five times as great— about $17 million per year at current money-market rates. There is yet another hidden subsidy: The Bureau assigns zero value to water lost by evaporation (100,000 acre-feet per year) from the reservoirs behind the dams. If a value equal to the marginal cost (at least $70 per acre-foot) of importing this amount of water into the Colorado River Basin is assigned, the subsidy would then amount to an additional seven million dollars per year.

The proponents of the projects say the proposed dams are necessary to provide a large accumulation of funds in a "Basin Account." This would be used to finance the long-distance importation of water into the Colorado River Basin. How is it possible to accumulate massive sums of money in the Basin Account—the Bureau calculates $900 million at the end of the initial 50-year period—if the Grand Canyon dams can contribute only $3.5 million per year, even on a subsidized basis?

The trick is that surplus revenue from the existing Hoover, Parker, and Davis Dams, all located on the lower Colorado, are put into the Basin Account, starting at the ends of the payout periods for each of those dams. These funds are then used to reduce rapidly the interest-bearing investment in the new dams. The result is to exaggerate greatly the importance of the new dams and to disguise the vital role of the existing dams. Actually, the amount of the Basin Account at the end of the 50-year period without the new dams would not be appreciably different from the amount with the new dams.

As previously stated, all of these calculations are based on a market value for the power of 6.0 mills per kilowatt-hour. At anything less than 5.5 mills per kilowatt-hour the revenue from the dams could not even cover the costs, even with the massive interest subsidies. Over most of the lifetime of the dams, their power will be sold in a market dominated by low-cost nuclear power. Already, even before the large-scale transition to nuclear power has taken place, the Bureau has not been able to sell the power generated at the new Glen Canyon Dam (just upstream from Grand Canyon) for 6.0 mills per kilowatt-hour. What will happen in the future is always a matter of some speculation, but it seems fair to say that no prudent investor would make a long-term commitment the success of which depended on obtaining a price of 6.0 mills per kilowatt-hour for the next one hundred years.

The more sophisticated among the proponents of the dams probably realize that they are not economically justified. But they know that if the dams are authorized and built it will always be possible to make sure that the Basin Account accumulates money. This would be done by passing legislation to assign a larger proportion of the investment in the dams to purposes which qualify for nonreimbursable and zero-interest funds. Elaborate rationalizations will be developed to justify the action. Most legislators, and certainly most members of the general public, will have little idea of the implications of the legislation. When it passes, the finances of the dams, from the very beginning of the project, will be recalculated on the new basis. The

effect will be to credit the Basin Account with an additional—and continuing— subsidy from the U.S. Treasury. Those who doubt the use of such mechanisms and the willingness of legislators to approve of them are encouraged to examine the legislative history of other federal dam projects.

The true purpose of the Grand Canyon dams thus becomes clear. They are intended to provide a respectable front for the siphoning of hundreds of millions—even billions—of dollars from the U.S. Treasury to the Basin Account. Because the dams are not economically justified, the cost to the U.S. Treasury will be far greater than if direct subsidies were made. Moreover, the national income will be lower than it would be if the dams were not built and lower-cost alternatives were built instead, as would happen in the normal course of events. But all of this counts for little to the proponents of the dams, who believe that it is easier to raid the Treasury for more money, if the raid is disguised, than it is to obtain a direct, openly stated subsidy of the same net amount to the Basin Account. And they, of course, need not pay the bill. That will be the role of the docile U.S. taxpayer, who will have no understanding of the choice that has been made for him.

New Thinking About Reclamation

Recently, there have been some encouraging indications that shifts in attitudes are taking place. In a speech given in July 1966, John A. Carver, then Under-Secretary of the Interior, as much as admitted that the traditional approach to the planning of water resource development was faulty. He stated that Congress and the public should be informed of the alternatives to hydropower as a means of financing water projects. He continued:

"Present procedures do not provide an adequate comparison of such alternatives. . . . Classically, legislation, whether for a project or a government policy, has been presented by the executive branch to the legislative branch as an act of advocacy, the best possible case for a particular course of action or a single project. The process of identifying alternatives—indeed of discovering if any exist—is left to the arena of countervailing powers in the political process."

In February 1967, Secretary of the Interior Stewart Udall announced that the administration was no longer supporting the proposed Grand Canyon dams, though he did leave the door open for later reconsideration of one of them, Hualapai Dam. The Secretary was asked by a reporter if this was a victory for the Sierra Club, the group that led the fight against the dams. Quite aptly he replied: "This isn't a victory for anyone. It's a victory for common sense."

The victory has not yet been won. Powerful men still want one or both of the dams to be built, and they have not given up. Speeches of Mr. Floyd Dominy, the Commissioner of the Bureau of Reclamation, have indicated less-than-complete acceptance by the Bureau of the recent shifts in administration policy. Congressman Wayne Aspinall of Colorado, chairman of the House Interior Committee, has announced his intention of reporting out a bill with one of the dams included. (Mr. Aspinall would solve the awkward problem of the infringement of Hualapai Reservoir on Grand Canyon National Monument and National Park by abolishing the National Monument and removing the westerly 13 miles from the National Park.) Senator Thomas Kuchel has introduced dam-authorizing legislation in the upper house. Some of the California Congressmen have announced their support of a measure with one or both dams; Congressman Craig Hosmer has introduced a bill essentially identical to the two-dam H.R. 4671.

Not without reason, the most fervent of the pro-dam people are the same ones who are forming the major opposition to another piece of proposed legislation. That is the authorization of a national water commission composed of individuals from outside of government, with demonstrated competence in the field of water policy and planning, appointed by the President. Presumably it would be relatively free of domination by agencies with vested interests in particular kinds of development. Congressman Aspinall gave his opinion of this on November 18, 1966, in a speech at the thirty-fifth annual convention of the National Reclamation Association in Albuquerque, New Mexico:

"I have been concerned with respect to some of the recent statements and reports originating with federal groups which are attempting to apply the scientific or theoretical approach to our national water problems. For instance, the Scientific Advisor to the President, Dr. Hornig, told the Senate Committee that the proposed National Water Commission would provide an overview of our national effort in water by some of the best thinkers and most experienced experts in the field, and provide for an independent evaluation of pressing problems beyond any commitment to state, local, or regional interests. How can an independent evaluation, free of state, regional, or local interests resolve complicated water issues involving water rights, interstate compacts, long-standing agreements, etc.? The recent report of the Committee on Water of the National Academy of Science, after discussing the changing objectives in the water field and the need for new policy, and after suggesting that perhaps the Reclamation program is outdated, concludes 'that a review of the federal reclamation policy, in the light of present and future competing needs for water and agricultural products, is a critical requirement.' You can imagine what might happen to water development in the West if the decisions were left to a group such as this."

Presumably Mr. Aspinall prefers the decision-making process as it now exists. An example was provided by Mr. Floyd Goss, the Chief Electrical Engineer and Assistant Manager of the Los Angeles Department of Water and Power (LADWP), the largest municipal utility in the U.S., at the March 1967 hearing before the Reclamation Subcommittee of the House Interior Committee. Testifying on the last day of the hearings, the chief engineer presented a

"brand new" proposal for Hualapai Dam: Expand its capacity from 1,500 Mw to 5,000 Mw by adding a pumped-storage feature—during off-peak hours, power would be purchased from steam plants and used to pump water from a reservoir at the foot of the dam to the reservoir behind the dam. When additional power generation was required this water would be allowed to flow back, through the turbines, to the lower reservoir.

This was not the first time that the advantages of pumped storage facilities had been brought before the committee. At the May 1966 hearings, I pointed out that such facilities could be used to meet peaking power requirements, that they could be located near the major load centers to reduce transmission costs, and that the costs of conversion of off-peak steam plant energy to peaking power using pumped storage gave an upper limit to the differential in value between off-peak and on-peak power. The contribution of the LADWP was to claim that the best place to build such a facility was in the Grand Canyon.

No supporting evidence was presented at the House Interior Committee hearings in March 1967 or at the Senate Interior Committee hearings in May. The most basic prerequisite for economic justification—a comparison of the proposed project with possible low-cost alternatives—was not even attempted. At these same hearings, I pointed out that there appeared to be at least two alternatives lower in cost—smaller pumped storage installations near the load centers, and a modification of Hoover Dam to provide pumped storage. The Hoover modification has considerable promise because excess transmission capacity is available there, and the cost of Hualapai Dam and Reservoir, a new construction camp, Coconino Dam and Reservoir, Paria Dam and Reservoir, and Hualapai afterbay—a total of $254 million—would be saved. Also saved would be the investment in transmission facilities from Hualapai Dam to Mead substation. Moreover, I noted an economic analysis of the LADWP proposal indicated that the additional capacity made available (over the Bureau's plan) would be obtained at the same unit cost as with the original proposal, and therefore hardly rated as a bargain.

When this information was presented to the Senate Interior Committee, it was not surprising that Senator Kuchel asked for, and received, permission for the LADWP to submit a rebuttal "in the interest of fairness and in the interest of making this record complete." It was also not surprising, to those acquainted with the quality of the decision-making process in this field, that the LADWP did not rebut. Yet the pro-dam Congressmen have been lining up behind the LADWP proposal, perhaps in the belief that what it lacks in quality can be overcome by novelty.

Damage to Grand Canyon

There is much more, of course, than the lack of economic justification for the dams that motivates most of the people who oppose them. The water behind the dams would not fill the Grand Canyon to its brim, and no one has made that claim. But it would flood out 148 miles of natural habitat and living space along the river and eventually destroy even more of it with sediment deposited as a result of the altered regimen of the stream.

Some of the outstanding gems of the geological entity that is the Grand Canyon would be inundated, along with some of the most extraordinary river sculpture on earth. (It should be remarked that the Grand Canyon, as defined by all responsible authorities, including the U.S. Board on Geographic Names, extends from Lee's Ferry to the Grand Wash Cliffs below the head of Lake Mead. Only the central portion is presently contained within the borders of the National Park.) These include Vasey's Paradise, Redwall Cavern, the lower part of Havasu Creek, Lava Falls, and Travertine Grotto. Much of the plant and animal life that, through the ages, have become uniquely adapted to the living river would perish. The last and oldest pages of what has been called the greatest open book of the earth's history would be covered, first by water, and then within a century or two by mud. What has taken the river 10 million years to create would take man a few years to destroy.

One of the favorite arguments of the proponents of the dams is that the depth of the reservoirs would be insignificant in the awesome depths of the canyon. That is very much a matter of one's point of view. From a vantage point on top of the Empire State Building it might not be too discomfiting if Manhattan Island were covered with water to a depth of ten feet, or even to a depth of 700 feet, the approximate height of Hualapai Dam. But the window displays on Fifth Avenue would never be the same.

Many people will see the heart of the canyon, by trail and by boat, if it is left as it is. In 1966 more than a thousand took river trips through the canyon; the number has been increasing by about 70 per cent each year. It is one of the great adventures available to the individual, and with modern equipment and proper leadership it is safe for everyone from the teenager to the senior citizen. The cost, about $20 per day including all expenses, is probably less than for a vacation in the city.

Many more people will never see the heart of the Grand Canyon, or the paintings in the Louvre, or the Taj Mahal. Yet the mere existence of such places is a source of satisfaction to them. They rejoice that not all of the natural and the manmade worlds are reduced to the monotony of the lowest common denominator.

If the heart of the Grand Canyon is ruined, its wholeness as an ecological and geological unit will be lost. It should remain, in its wild and natural state, as an example of man's love for the land and his determination that at least a few places should be saved. Future generations of Americans will need to know what the land was like before man's brief instant on the immense expanse of geological time. They will want to know the answers to questions not yet asked by us in our ignorance, answers to be found in the study of the natural world, if we let examples of it survive outside the overbearing influence of man. They will want

to experience the wonders of this natural world for the re-creation of the spirit that it can provide—for the insight into man's place in the universe.

The Real Choice Before Us

The crucial resource is not more water, nor is it more power, important though these may be. It is man's spirit. If the options were more water and power on the one hand and an intact Grand Canyon on the other hand, we should choose the canyon.

Many people, if that choice were put to them, would decide otherwise. They would prefer a continuation of the growth—usually devoid of form, style, and beauty—that is irrevocably altering the face of the American earth.

But the choice is not between growth and the canyon. Economically rational reasons for exploiting the Grand Canyon disappeared with the advent of new power technology.

The choice is simply this: Shall we continue an outmoded reclamation program, or shall we insist that it be replaced by rational planning as a way of solving our national water problems?

The canyon would be essentially 'dead' if the living river were stilled. . . . We will convert the canyon from a working geological laboratory into a museum piece, a petrified instant-in-time. But I question whether this is truly the full extent of the damage we stand to do. What happens to the form of a canyon when the river which carved it stops flowing?

We would have taken the authority on ourselves to reverse the direction of the canyon's development. Such an action would foreclose forever the chance that the distant future would see an even more spectacular canyon than we know today. Are we to assume—a classic mistake—that the superlatives of our own experience constitute ultimate expressions?

— Larry R. Harrington

A mathematician at Los Alamos Scientific Laboratory appraises the effects of the proposed Hooker dam

Gentle Wilderness in Jeopardy

MICHAEL WILLIAMS

ONE OF THE MOST delightful places in all the Southwest is the Gila Wilderness, in southwestern New Mexico, and the focus of this vast area is the Gila River. From near Gila Hot Springs, the Gila River Canyon is untouched by road for 32 miles before Forest Road 155 winds off the south rim to meet the stream near the confluence of Turkey Creek. Some five miles below Turkey Creek is the end of the Gila River Gorge—and Hooker damsite. A dam here, with a proposed capacity of 265,000 acre-feet, would back water through the Gila Primitive Area and some nine miles into the Gila Wilderness.

This is a friendly wilderness. The Gila River brings to the canyon bottom the magic that water produces in the arid Southwest. The pathway formed by the bottomland is alluring to hikers and horsemen. The forest road near Turkey Creek gradually fades into an abandoned wagon road nearly recaptured by lush vegetation. The old road's scar has long since healed to a pleasant leaf-covered path, shaded by overhanging alders, oaks, and sycamores. Occasionally it crosses the river, refreshing the traveler in summer and chilling him in December. As the road continues beyond the Primitive Area, it fades into a trail, the principal access to the southern part of the wilderness.

The experience of the Gila is not the rugged grandeur of deep gorge, high waterfall, or towering crag; instead, travelers enjoy a relaxing charm. In the area near the confluence of Turkey Creek, the river runs in a wide flat. Upstream the canyon walls close in, but they never pinch off the bottomland. Grasses, streamside willows, alders, sycamores, cottonwoods, oaks, occasional ponderosa or chihuahua pine—these are a pleasant change from the broad expanses of sagebrush, juniper, and pinyon that usually greet the Southwesterner. So are the rock walls, with occasional grooves and chambers sculptured by summer freshets, that are the backdrop for the river or the green bottomlands. The river itself doesn't roar or shout; its riffles and pools chuckle and whisper.

Side canyons are highlights of a walk up the Gila Gorge: Cave Canyon, with its small stream trickling through a passage under boulders; Spring, with its waterfall and ferns; Shelley, with a little waterfall carving its sculptured and fluted entrance. Occasionally the walls of the canyon fall back to reveal vistas of the canyonsides. Tiers of rock faces are separated by wide bands of pinyon- and juniper-dotted slopes, and the bands of cliffs are of many hues. Each canyon has its own charm.

Wildlife is here too. You may spot a blue heron before it takes wing to a more secluded retreat. A rare Mexican black hawk sails overhead. Tracks in the river mud show that wild turkey, raccoons, and mule deer have been there before you. The broad-leafed cottonwoods growing between Turkey Creek and the damsite are found in New Mexico only here or farther downstream on the Gila. The chihuahua pine is found in only two other places in New Mexico. The sycamore and broad-leafed cottonwood join to form the Gila River cottonwood-sycamore riparian association. Found in only a few places in the country, this particular combination forms one of our most devastated habitats. Types of riparian and avian life, including the Gila monster and the Mexican black hawk, have a similarly restricted range. Since their habitat—fertile, wet bottomland—is also prized by man, their range is rapidly diminishing. These species and habitats need protection.

The fish in the Gila were unique at one time. The Gila trout that once inhabited most of the wilderness streams has now been almost completely replaced by exotic species planted by man. Four species of minnows and two of suckers are native. Two of the minnows, *Tiaroga cobitis* and *Meda fulgida*, are threatened species; their loss here would mean their complete disappearance. A third species, *Gila robusta*, is considered a disappearing species.

The Gila is our nation's oldest Wilderness Area. It was established in 1924 through the efforts of the renowned conservationist, Aldo Leopold, in coöperation with Clinton P. Anderson, now Senator from New Mexico. The "Gila Primitive Area," established with 574,000 acres, was enlarged to 695,000 acres in 1930. But in 1931, a road was cut through from Mimbres to Beaverhead Ranger Station, slicing off the 132,000-acre Black Range Primitive Area. A road was built up Copperas Canyon in the 1930's, ostensibly for fire control; a 3,000-acre corridor was removed from the wilderness along the road, practically severing the present Gila Primitive Area from the Wilderness Area. In 1944, 5,150 acres were removed for mining. Then in a 1953 reclassification by the Forest Service, only 438,626 acres were classified as a wilderness area. In 1964 the Wilderness Act was passed—to put an end to such raids, one would hope.

We are now faced, however, with authorization of a dam and reservoir that would destroy the best of nearly one-third of the Gila River Gorge in the Gila Wilderness. We have already been told that the area south of the Gila

River is a prime target for deletion from the wilderness. If the Gila Wilderness Area, the oldest, is successfully invaded and dismembered, will any wildernesses be safe from "peripheral" intrusions that cut to their hearts?

Hooker dam would make available to New Mexico 18,000 acre-feet of water per year that would otherwise flow downstream to Arizona users. It is the price of New Mexico's support for the Central Arizona Project (just as proposed dams in Grand Canyon were intended as one price of support for the CAP by other Colorado Basin States). The only incontestable reason for building Hooker is that the damsite is there.

According to Bureau of Reclamation estimates, 10,000 acre-feet of Hooker water per year would be used by industry. But the only industrial user in sight, Phelps-Dodge, has bought up water rights in the area and says it has all the water it will need in the foreseeable future. The Bureau estimates 800 acre-feet will go to municipal users in Silver City. But a $4.5 million pipeline would have to be built to serve Silver City, which used only 1,000 acre-feet of water (from other sources) in 1965, and this would add substantially to the $55 per acre-foot cost of municipal water at the damsite. The Bureau (whose primary function is to supply irrigation water) estimated six years ago that only 700 acre-feet would be used for irrigation. Many of the acres that might have been irrigated are those since bought up for their water rights by Phelps-Dodge, and will probably be withdrawn from agricultural use. One hundred acre-feet of the total 18,000 acre-feet are not allocated in the Bureau's estimate. The remainder, 6,400 acre-feet, would be wasted by evaporation. It is by no means clear that New Mexico has an immediate or foreseeable use for Hooker's water.

Reservoirs operated primarily for water storage are ill-adapted for flood-control. But the Bureau of Reclamation claims annual flood-control benefits of $70,000 for Hooker, a Corps of Engineers' estimate that assumed Hooker would be operated *solely* for flood control. Annual fishery benefits are estimated at $372,000, but seasonal fluctuations of 15 to 20 feet in reservoir level would destroy the life zone that produces most of the food for game fish. Other claimed benefits are estimated at so low a figure, $28,600 annually, that they affect the economics of a $25 million project very little.

Even if the destruction of wilderness values was not regarded as part of its true cost, Hooker's justification would be hard to discern. The dam's only real purpose, it seems apparent, is to reserve New Mexico's right to 18,000 acre-feet of water per year.

Somehow, somewhere, there must be some other way of adding that 18,000 acre-feet of water to New Mexico without further diminishing New Mexico's scenic resources—if that further 18,000 acre-feet is absolutely essential to keeping New Mexico a desirable place to live. We have a feeling that keeping the Gila River a wild river throughout its upper reaches is going to do more good in the long run for a state that respects its heritage of beauty than another dam would do. Why, for example, could New Mexico not add the 18,000 to its allocation by diverting that much more from the San Juan River, through the San Juan-Chama diversion, rather than from the upper Gila. It should make little difference to Arizona whether it pays this much to New Mexico from one river or the other. Or why could there not be a contribution from Arizona and the federal government to add wells near Silver City, New Mexico, and to provide for pumping power. Another dam now, followed by another phreatophyte farm in the Southwest when the dam silts in, is not going to let New Mexico citizens of the future enjoy, on the Gila, the kind of thing Aldo Leopold was talking about when he fathered the wilderness idea for the U.S. Forest Service. People are willing to pay more and more for beauty these days. The natural beauty of the Gila cannot be restored if it is lost. As the late Clair Engle put it, "You can't unfry that egg."

—D.B.

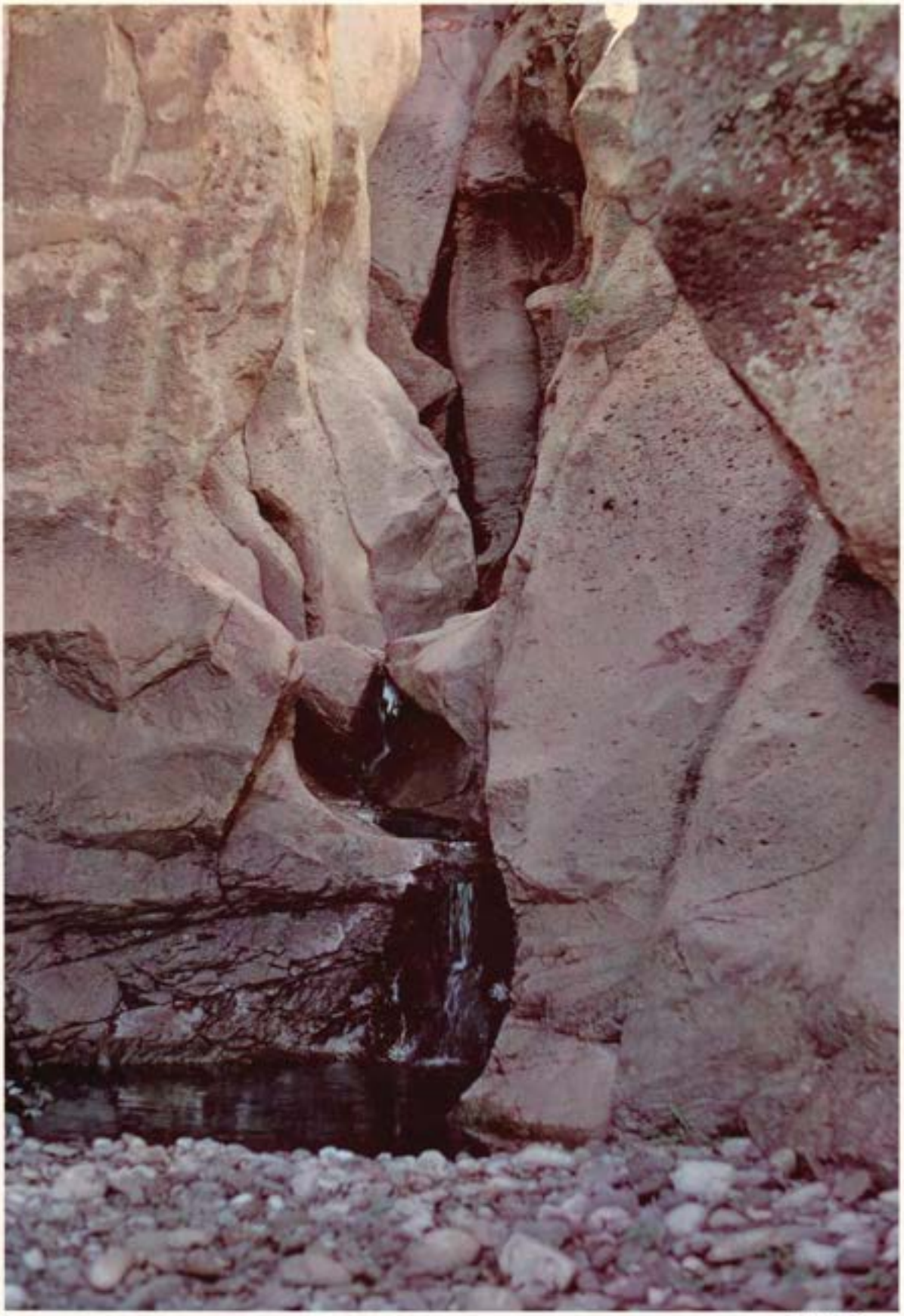
Mile 17

The Gila's Gentle Wilderness

Man always kills the thing he loves, and so we the pioneers have killed our wilderness. Some say we had to. Be that as it may, I am glad I shall never be young without wild country to be young in. Of what avail are forty freedoms without a blank spot on the map?

ALDO LEOPOLD

PHOTOGRAPHS BY JOHN McCOMB OF GILA GORGE COUNTRY
THAT THE PROPOSED HOOKER DAM WOULD INUNDATE



Mile 20

The dam would be located outside the Gila Wilderness and Primitive Areas, and the reservoir would back water only a few miles inside these areas which, at this point, are comprised of typical, undistinguished, sparsely vegetated, desert hills located in close proximity to state highways, towns, and farmsteads.

FLOYD DOMINY

letter to Congressman John P. Saylor, Oct. 24, 1967

It is legitimate to hope that there may be left . . . the special kind of human mark, the special record of human passage, that distinguishes man from all other species. It is rare enough among men, impossible to any other form of life. *It is simply the deliberate and chosen refusal to make any marks at all.*

WALLACE STEGNER

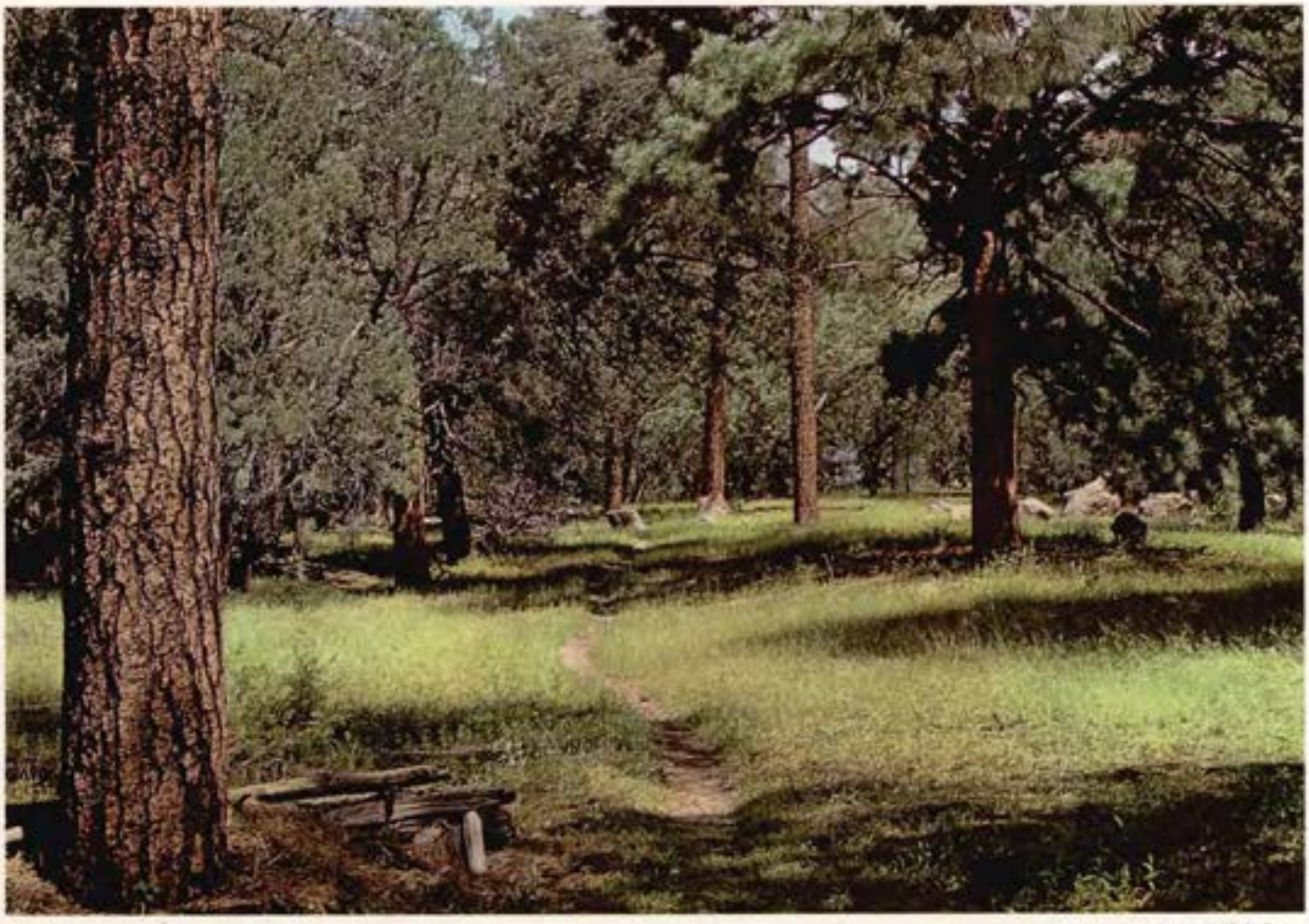
from *This Is Dinosaur*

Mile 20.5

We cannot tell you how large that reservoir would need to be in order to comply with this requirement. Reconnaissance studies indicate a capacity would be required of something like 265,000 acre-feet as compared to the 98,000 that was originally contemplated. . . . We have not had the time nor the funds to make the full study that would be necessary before we could say how large you would have to have a storage catchment in order to comply with that agreement.

FLOYD DOMINY

Testimony, House hearings, Jan. 30, 1968 (first transcript)

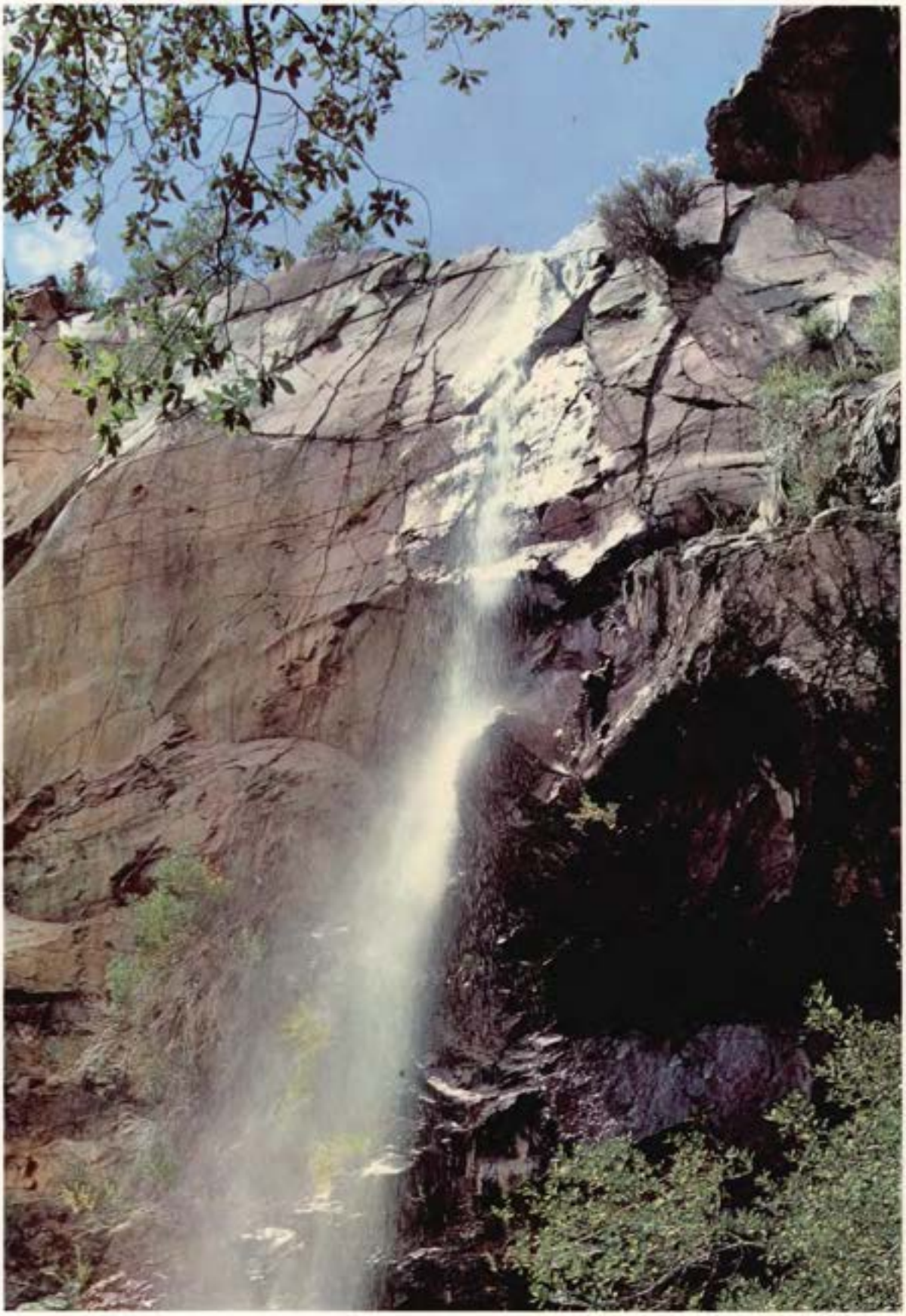


Mile 21.9

We have heard rumbles of protest from The Wilderness Society that the Hooker dam and reservoir would invade the Gila Wilderness Area. It is true that the dam would back water up the narrow canyon floor a short distance. This would be an added value of the reservoir as it would enhance the beauty of this area, leaving open for rowboating or canoeing a tiny segment of the wilderness now subjected to flooding and erosion, leaving only sandbars and gravel piles enjoyed by no one, not even wildlife.

ALVIN ELLIS FRANKS

President, Hooker Dam Association



Mile 19.8

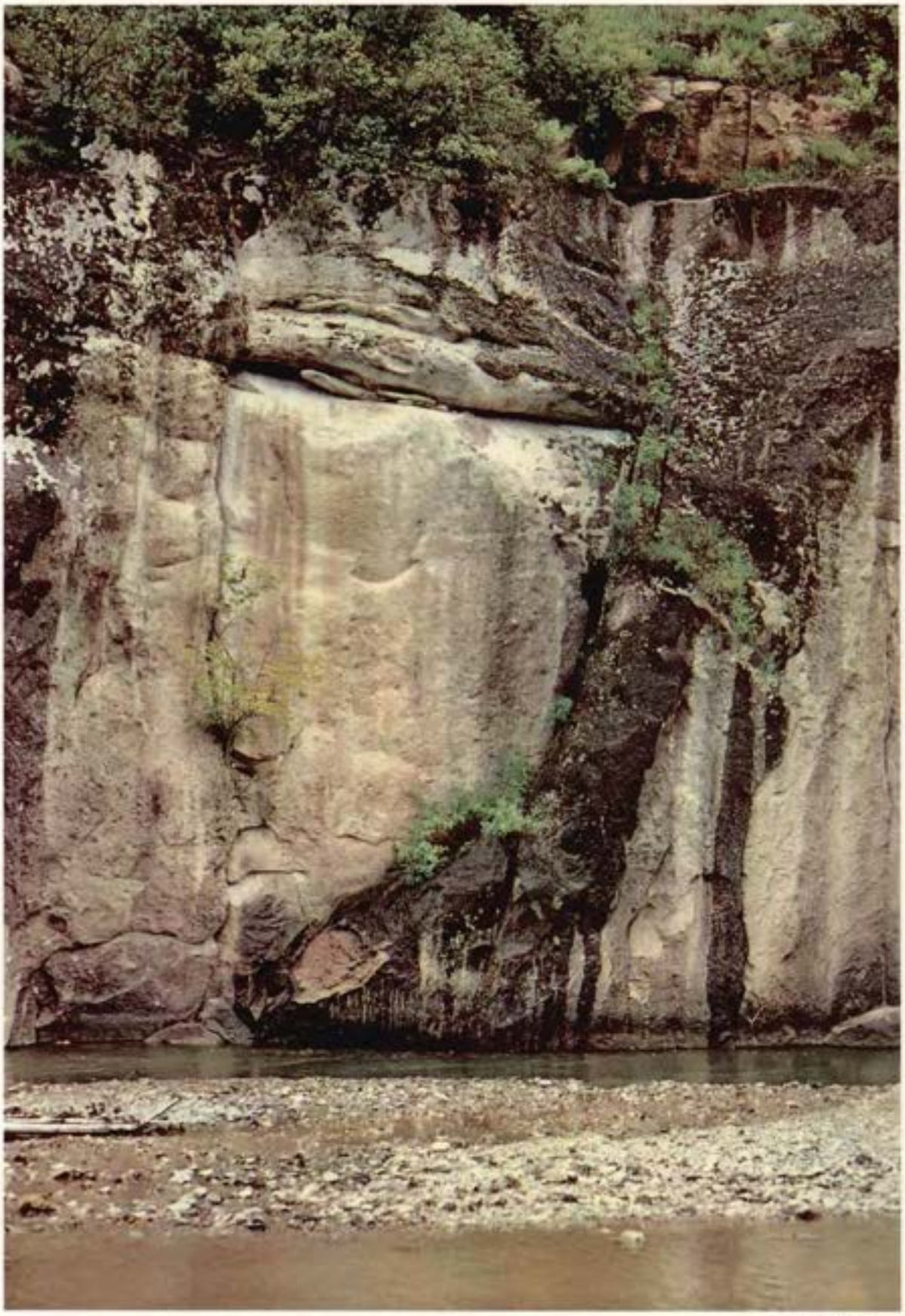
It is a better world with some buffalo left in it, a richer world with some gorgeous canyons unmarred by signboards, hot-dog stands, super highways, or high-tension lines, undrowned by power or irrigation reservoirs. If we preserved as parks only those places that have no economic possibilities, we would have no parks. And in the decades to come, it will not be only the buffalo and the trumpeter swan who need sanctuaries. Our own species is going to need them too.

It needs them now.

WALLACE STEGNER

from *This Is Dinosaur*

Mile 23



Mile 23

Mile 23.5

Senator, I want to go on the record on this point. I think this can very accurately be described as a very peripheral wilderness involvement. I think that we have to be flexible enough concerning the wilderness system, because we are going to see, from time to time, problems like this arise, to be able to modify boundaries, and exclude small areas, particularly where a minimum peripheral invasion is involved. We should be flexible and maybe compensate by putting a little more land in the wilderness areas elsewhere.

STEWART L. UDALL

. . . the nation will have lost, the West will have lost, the future will have lost. In spite of former Senator Watkins' feeling that we ought to help establish a few wildernesses in other parts of the country and let the West get on with its lumbering and mining, it has never been man's gift to make wilderness. But he can make deserts, and has.

WALLACE STEGNER

from *Wildlands In Our Civilization*

A National Park for the Sonoran Desert

→»» Morris K. Udall

When the Rio Grande Chapter's third conference on Natural Areas in the Southwest was held in Santa Fe in November 1966, many of the most pleasant moments were provided by the Honorable Morris K. Udall, Congressman from Arizona. The way the speech was delivered counted for as much as the content, and consequently every effort has been made in transcribing it to preserve the flavor and ease of Mr. Udall's style. The Conference was organized by Jeffrey Ingram, the club's Southwest Representative, who introduced Mr. Udall.

Mr. Ingram: If there were a Sierra Club meeting that went on for as long as this one has and the Grand Canyon were not mentioned one way or the other it would be surprising. [Laughter.]

I confronted the problem of how to introduce Congressman Udall—without making any sly remarks about the Grand Canyon and still keep a straight face—with some trepidation. I never solved the problem so I just decided to put it on the line: that if his energy and his persuasiveness and his patience and his humor were on our side in this fight, we would today have a Grand Canyon National Park which included all of the Grand Canyon [applause]. That applause was for you, Mr. Udall.

Fortunately, very fortunately, these qualities of his usually are on our side, so it is with a straight face, and a very great deal of pleasure, that I introduce him to you today to talk about the proposal to establish a national park in the Sonoran Desert in southern Arizona.

Congressman Udall: Precinct workers and fellow Democrats [laughter]. . . .

I just got back from a meeting in Washington that was more like a wake; to some of the Democratic leaders I announced that this was the first annual meeting of the survivors of the Bataan Death March [laughter], but somebody said he had seen written on the subway walls "God is Dead," and somebody had come along and written underneath it: "Would you believe seriously ill?" [Laughter.]

This is a little bit the way the Democratic party feels today in Arizona and around the nation.

But I am happy to be with you. I debated about coming to the Sierra Club meeting, but after some unfortunate and intemperate remarks on both sides in the late controversy, Jeff and Dave Brower and I had some meetings in which we restored some of the good feeling that has always existed.

I know I carried on a feud with an old friend of mine and then we became friends and collaborators. On a particular project, I wrote him a letter, and the salutation was "Dear Friend (Formerly, you lousy fink)" [Laughter.]

Or the old Congressional standby: the telegram that reads, "Dear Congressman. (Go to hell. Strong letter follows.") [Laughter.]

But anyway I wanted you to know that I am happy to be with you. The Scriptures admonish us to love thine enemy and do good to them that smite you and so on, and I even let the old grads down in homecoming in Tucson in order to be here today. We have lost five in a row and it'll be six today, I guess. I haven't seen the wires. The only one we won this year was the New Mexico Lobos. [Laughter.] You remember the old *New Yorker* cartoon where the two old grads were standing there in the stands and the crowd filing out and the scoreboard says "Local zero, visitors thirty-five," and they had their hip flasks and were obviously perturbed because they lost six in a row apparently, and one says to the other, "No, I don't mean in effigy, I mean let's really hang him." [Laughter.]

I was afraid that might be the reception that I would get here today.

I can't think of any assignment worse than to talk to a meeting at five o'clock when the proceedings started at nine-thirty. I don't have a prepared text. I made some notes on the back of an old envelope. This has worked for some politicians. This may be known some day as the Santa Fe address. [Laughter.]

But some of you would probably like some refreshment at this time of day stronger than coffee and apples. If you give me fifteen or twenty minutes to ramble and counsel with you a little bit on this Sonoran Desert Park proposal and perhaps a few other things, maybe privately and quietly in small groups, we can talk about the Grand Can-

yon and other current problems later on this evening. I am going to be able to stay overnight and stay on for the dinner.

One of the speakers here mentioned the fact that you need an emotional content as the driving force, and we do, and I think your organization and the allied groups have participated in really a great leap forward. The conservation movement in this country has gone between intermittent leaps compressed into a small period of time and long decades of stagnation. Theodore Roosevelt set up the national forests. We had several years of Ickes and Roosevelt and really some big steps forward. We didn't have any new national parks for about twenty years until the late '50's and early '60's when this movement began. It moves forward with a great content of emotionalism. But I am afraid on both sides of controversies like the Grand Canyon there is a temptation to get a little bit bitter and let the invective roll.

It's like the story of the editor: They asked him how he stood on a burning issue and he said, "Well, I haven't made up my mind but when I do I'll be bitter." And I think if I could counsel with you, speaking generally, that there's been a tendency on the part of both sides to overstate the case, to ignore the sound solid points that the other side has to make. I think you can fight these battles and feel very strongly, and feel emotional about them. But I have pledged myself never to attack the motive or the sincerity of the people on the other side, and I think we would all do well to do this. You can go to the little towns in my district that are based on an agricultural economy—and we in Arizona, I think, are foolish to let this desert go into production and to pump out this resource that was put there over millions of years. Yet I think you can feel how the farmer might react to the problem because between last year and today the well has gone down ten feet more, and the politicians have been threatening or promising to save the river for the last fifty years in the fall of each and every even numbered year, and the farmer sees his costs going up and the water supply going down. He gets a little desperate and he's inclined to suspect the motives of other people, to pass them off as a bunch of vicious do-gooders and so on.

I think we can reason together. We can hit hard and we can disagree, but I hope we will continue to do as we have done in recent months on this Grand Canyon controversy —at least respect the sincerity of the other fellow's motives and his point of view.

I was lobbying one Cleveland Congressman for a vote on my water bill—Colorado Water Bill—last year, and he said, "I may go with you, Mo, but I am good for only one desecration a year." (It was when we were having the fight over extending the west side of the Capitol.) "It has to be either the westfront or the Grand Canyon." [Laughter.]

Well, you can be opposed to all desecrations, I suppose, but I do regret any intemperate remarks I have made or any time I have questioned the motives of the really good fine people that are in these related organizations.

I am just going to hit two or three of the major points in addition to the Sonoran Desert Park, which is the subject I did come to discuss here today, but having come back from the wake in Washington and talking to my fellow Democrats surviving the massacre at the Little Big Horn, let's talk about the new Congress for just a moment, because you might be interested in some observations on this.

We are going to have seventy-three people in the House of Representatives in January who weren't there in the last Congress, and it's hard to generalize. I don't say this from a partisan standpoint because we've had many great leaders—John Saylor and Larry Burton of Utah just to mention two, because we have a few Utah people here I understand. The new Republican party has fought the fight and they've done it many times when there wasn't any political gain and it wasn't in their best interests.

But as I analyze the seventy-three people who departed, by and large the cause of conservation and preservation is going to be weaker than it is now, just on our committee. We've lost the Chairman of the National Park Subcommittee, Congressman Rivers of Alaska; and Congressman O'Brien of New York who fought so many fights is gone. I think we have eight or nine vacancies on that Interior Committee, which will be writing the redwoods bill and some of the other legislation you are interested in. I think the new Congress is going to be far less likely to appropriate the money we need, and we need a lot of it right now. I am afraid that big new expenditures for this are going to be pretty hard to get in the conservation field.

We have this dreadful circle that we go around in. If we don't enact the national parks legislation and the wild rivers and the redwoods bills that we need now, we're not going to get them. It's going to be too late. Inland Steel is going to have the Indiana Dunes and we face that now. If you wait very long some of these places that need preserving are going to be gone.

But we're so short on money that we can't pay for the ones we have. One of the big things we ran into with Indiana Dunes was that here we've authorized all these new national parks and monuments and seashores and lakeshores and all the rest and we don't have the money to buy them, and the costs keep going up and the speculators move in. And yet, as I say, if we don't enact the bills now it may very well be too late and all is lost.

So this is one of the dilemmas we're going to face in the new Congress.

I think it's no accident—again, without being partisan because I give full credit to the many fine members of the party who helped us—it's been no accident, this great leap of the last six years, which I think is unparalleled in history, the progress we've made—the wilderness bill, the land and water conservation fund, and the seashore concept and the lakeshore concept, the wild rivers concept, and the many other things that we've done. But this happened at a time

when we had large majorities in the Democratic party and a lot of new freshmen who were imbued with the conservation idea, and there's work to be done yet. Oregon Dunes eluded us; Sleeping Bear in Michigan eluded us; the redwoods eluded us, we lost a few other battles, and these are battles that are going to have to be fought in the new Congress and I can't come to you today and be very optimistic about it, because I think we are going to be a little bit weaker, somewhat weaker in this Congress than we were in the last.

So in this context let me talk about the Sonoran Desert National Park for just a moment. I wish we had maps here. I wish we had some pictures. We have some slides that I had shown in Tucson at a mass meeting a few months ago. We have an *Arizona Highways* that did an issue on Organ Pipe National Monument and on the proposed national park.

But one of the great opportunities this next year, in the light of the trouble we have, is that this is a park that doesn't cost any money. It's all federal land. This new park would be made up of three components: The Organ Pipe Cactus National Monument, about three hundred thirty some odd thousand acres; another eight hundred and some odd thousand acres, which are now in the Cabeza Prieta Game Refuge under federal administration—the Bureau of Sport Fisheries and Wildlife; then we are going to take, if the proposal is enacted, another forty or fifty thousand acres out of the west that are now in public ownership and administered by the Bureau of Land Management. So the proposal is to take about a million point two acres, including the present national monument, and make it into one big new national park. This would be the seventh largest national park. It would be bigger than Grand Canyon National Park, although perhaps not as big if some of the plans of members of this group are carried out in connection with Grand Canyon National Park.

This is a really unique and unusual area and we've got some other things going for us, too.

When the national monument was established in Organ Pipe, this beautiful, beautiful area, there was this old pioneering family there that had several thousand acres of grazing land and they were protected in the National Monument. I am sure you have all read some of the articles about what the overgrazing had done and the threat that it posed to some of the delicate plants, the ecological balance there. In the last year we were finally able to work out a sale so that these people are moving out and the federal government is buying up their claims and this threat will be eliminated, one obstacle will be eliminated to making it a national park. I am sure Congress wouldn't make this a national park if the grazing had continued or there were any grazing rights. There are a few mining claims still left in the Organ Pipe National Monument and these will have to be bought up, but fortunately there are no huge copper deposits of the kind that there are close to it.

This park then would extend for sixty miles along the Arizona-Mexico border, and it would include a most unusual part of the country. I flew over it in my airplane the other day on the way to Yuma. You think you're on the moon, it's that barren. It's stark; it's very exciting and it's unique and unusual. But one of the things about this proposal is that on the Mexican side of the border—I am sure there are some of you who have seen this—there's an area called the Pinacate Lava Fields. This is a million or so acres, with the Pinacate Peak looming off in the distance—and this adds again to this feeling that you are off on some alien planet—with this stark black landscape and really strange types of plants that you find, the remnants of this Sonoran Desert as they penetrate to the north — really strange kinds of cacti and unusual plants.

And there have been some preliminary discussions along the lines that if United States will make this a national park, our part of it, that we could then persuade the Mexican government to set aside the Pinacate area as a Mexican national park, so you would have back-to-back across sixty miles of this border two great national parks. You would have an International Park, similar to what we have on the Canadian border up in Montana. This is one of the really nice features; one of the intriguing ideas.

Another problem that we would have to resolve in this connection is that the Cabeza Prieta Game Refuge has been withdrawn and is being used by the military. This huge area, as I say, sixty to seventy miles long, is used by the jets for training out of Williams and Yuma and Luke and the other military bases. But they do not make any ground use of it. It is simply used air-to-air, an area to run through to make passes at tow targets and things of this kind. But with changing military technology and the speed of these jets, supersonic speed of the jets, sixty miles would be nothing. You could go through that in two or three minutes and you would have to start turning as soon as you come into it, and more and more the military are telling me they are going to have to be doing this kind of thing out to sea. This is the only type of place where you have the room to undertake this military training.

So the proposal in my bill is that we go ahead and create the national park, including the Cabeza Prieta Game Range, but that the game range part of it go into the national park only at such time as the military has finished with its military uses in the area and turned it back. If we don't do something like this, the military may well find that they need it for ground maneuvering areas in which case it will be torn up very badly with tanks and trucks and vehicles going across it. But it's an important time to move and we can get it all for nothing. We can get the job done and have a new national park without any outlay for the acquisition of land.

In the context of the makeup and the attitudes of this new Congress and with the Vietnamese war hanging over all expenditure proposals, this may be a big gain that we could make in this Congress.

Well, I am asked, "Why should we preserve this? What opposition to it is there?"

I will cover the points of opposition to it, but the basic reason why we should preserve it is that this is an unusual area—this has no counterpart. What we tried to do in the National Park System, this unique American concept, is to get big, huge chunks of really unusual, beautiful land that exemplifies a particular kind of terrain, a particular kind of flora and fauna in this country, and to set them aside. This isn't like Death Valley. It's entirely different. This Sonoran Desert starts down in Mexico and penetrates just a little way into the United States. It's entirely different from the Mojave Desert in so many respects. It's entirely different from Death Valley. This Cabeza Prieta Game Range is somewhat different from the Organ Pipe National Monument. It's different from the Saguaro National Monument over by Tucson, which is at a much higher elevation, with a considerably greater growth of desert plants. So the reason we should preserve it is that it is a starkly beautiful area. It's different. It's barren, and some of the objectors say, "Well, this is just a barren waste." This is one reason to preserve it. We don't have anything else like this in the United States and a chunk of it ought to be preserved for that very reason. I was trying to think of some—in sponsoring this legislation and pushing for it next year—some quotation that I could find from a learned man, a famous man, and I found one. I guess some famous philosopher, Socrates, or someone—perhaps it was even I—who said it: "Leave it as it is, you cannot improve upon it." [Laughter.]

All right, what do the opponents say? We are getting considerable static in Arizona. In fact, I don't even have definite sponsorship from the other members of the Arizona Congressional delegation and this is often fatal—they haven't said "no," but they haven't said "yes" on it either. You almost have to have—the political realities being what they are—the sponsorship of the members in Congress from the state. This can be a problem. But here are some of the objections, and the main ones come from the hunters, that it would rob the hunters of Arizona of a hunting area. Now, this has never been a significant hunting area. It was set up, the Cabeza Prieta Game Refuge was set up, to preserve the desert bighorn sheep (a very unusual and interesting animal) plus some of the pronghorned antelope—the little desert antelope that are in that area. I think we can preserve the antelope and bighorn sheep and still preserve the area as a national park. But this is the basis on which most of the Arizona opposition is, and nearly all the writers on fish and wildlife and outdoor writers in Arizona are opposed to it on the grounds that the Park Service does not manage game the way game ought to be managed, and if we turn it over to the Park Service we are not going to be able to preserve and hunt the pronghorned desert antelope and the bighorn desert sheep.

Another objection made by the people in Arizona is that the national park will open up a wilderness to tourists who will mess it up, in a phrase. Well, I think we can see that this hasn't been done in any of the other national parks. Any roads or trails ought to be very inconspicuous and leave great chunks of this thing for all time to come. One of the strongest objections that's made I've covered—that this is not of national park caliber. It's not Rocky Mountain, it's not Grand Canyon, it's not Glacier, it's not Yellowstone. And I will agree that to many people on first blush when they go in and see it, it is a barren wasteland. But this is the charm of it. Yellowstone isn't Grand Canyon, and Yellowstone isn't Death Valley. This has a uniqueness that you don't find anywhere in the country, and to those I have talked to who studied it, who have sound judgment, this is of national park caliber and should be preserved for that reason.

These are the major objections. I do not tell you that we have the support for it that we need. We need help and we need support.

Now, I am asked, "What can you do about it, if you believe after studying it that it has national park caliber and should be preserved?"

To those of you who want information I have a limited number of the Park Service preliminary report on it. Probably I can get these reproduced if we have to. I think we could find some more of these *Arizona Highways* to give facts and figures and information about it.

What can an organization like the Sierra Club do in a fight of this kind? Of course, we need to make this a national program, a national objective, a national effort. You don't get a national park established simply because a couple of Congressmen from one state want it. It has to have broad support from all over the country. I've seen what your mimeograph machines can do and the way you can stir up little old ladies in tennis shoes in Michigan, school children in North Carolina—Dave Brower and others. If you believe with me that this is worth saving and I just wish we had some slides here to show you, then we need a national publicity campaign by all the organizations that would help with this kind of proposal. We need co-sponsors of this legislation. I very often co-sponsored bills. I threw in an Indiana Dunes bill and helped carry the fight. I put in a redwoods bill. I put in bills for national parks in other areas. This gives it a national movement flavor and helps if we can get co-sponsors, members of Congress, and the kind of people that you might influence to throw in a bill to show that it just isn't one Arizona Congressman that has a bright idea. It becomes a prospect. But it gives a national flavor to it when you get co-sponsors for legislation from other areas, and this is a field where you could give me some help.

Jeff, that's about all that I wanted to say at this late hour of the day on the Sonoran Desert National Park. If we had more time we could go into more detail.

Let me leave you with one other really serious observation of a general nature. I've made this pitch to every kind of conservation, preservation group that I've talked to in the last couple of years, because I think it's the whole heart

of the problem. We can carry on these fights and we can carve out some more wilderness and some more national parks. But we're nearly all done. The land use pattern in this country is almost fixed. We may have one or two more national parks, or three. That's about all we're going to get. I don't think there are many more lakeshores or seashores that are going to be saved. We may save a few wild rivers. We may do the redwoods and clean up the odds and ends that we failed on, but the land use pattern in this country is fixed, almost. Just like they're fixed in Europe. There's no chance in Europe to start a national park system. It's gone. It's been set for centuries. And we've just about reached that point here. And from here on out, I think, the challenge of doing something about preserving outdoor areas for people who want solitude and wilderness and outdoor experience, winning this fight in the next thirty, forty, fifty years, is going to depend on winning the population fight, because I think this country could support a billion people. We can double-deck everything, the freeways and skyscrapers and all the rest; we can enlarge our cities and build new cities. But you can't double-deck your parks and you can't double-deck your seashores. You've only got so many. I can take you to any city council or any legislature in this country, or any session of Congress, and there'll be four or five burning issues. It may be a road through some park in Denver or it may be some problem down in Albuquerque about tearing down an old house, or a subdivision in a wilderness, or a wild area, but it all relates to this conflict between more and more American people pressing in upon a smaller and smaller area of national resources. We're going to have sixty million more people by the end of the century at least, if not more, and these are not just statistics—these are people that want to go to the mountains and ski, and they want to play golf, and they want to go to the park the same time you do. They want to see Yellowstone and Grand Canyon and they are going to want to own a car and they're going to want freeways to get to work and all the rest. I seriously say to you that we are fighting a losing battle unless we begin to check the population explosion, and I say this as the father of six children. I was making this pitch on television one night saying, "You know, really, every problem we have, we confront, gets back to this population explosion. We have higher taxes for the school. Why? More children. We've got fights about freeways and roads. Why? Children. We've got trouble in foreign lands. Why? Because the population is exploding and living standards going down. More children." And the fellow said, the interviewer said, "Well, that's very interesting Congressman Udall, what do you propose to do about this?" And I said, "As a father of six I can't do very much about it." [Laughter.]

But this is a battle and I think the time is going to come, if you want a constructive suggestion, when the Sierra Club and the National Parks Association and the Garden Clubs and all the groups in the conservation movement ought to have a vice president who works on the population question. You ought to align yourselves with the Planned Parenthood people, if you please.

I introduced the first population bill that was ever introduced in the House of Representatives. The first one. A companion bill to Senator Gruening's bill, and I was told this was suicide—political suicide. Well, the people are way ahead of the politicians on this one as we have seen in just the last couple of years. It's no longer dangerous to introduce the kind of a bill that I introduced three years ago. But I would like to see conservation organizations coming in and giving testimony, not just on the new parks and the wilderness and the new lake shores and wild rivers and the redwoods bill, but coming in, giving testimony, and writing letters, and cranking up your mimeographs, and getting out bulletins, when population legislation is being considered. We've had a lot of victories together; we fought the Grand Canyon battle on opposite sides, but basically I'm on your team on this thing.

But I think in the long-run, long-range, we lose the whole ball game unless we do something in this field. I wish the population of this country would remain stable at about a hundred and twenty-five or a hundred and fifty million people. We'd be able to do all the things nationally and internationally. But it hasn't. And we're not going to solve this problem overnight.

We've had our differences. I haven't had much sleep since Tuesday night and I'm finding out that I can be funny without even trying.

But I wanted you to know that I come in peace. I'm among friends. I'm on your side. It's like one of my Alabama Congressman's favorite stories—when I think about all the ones I've picked up from these Southerners—he tells about the fellow that goes to the annual costume ball dressed as a devil and he has a pitchfork and a mask and he looks very fierce, and has a tail. He had too many libations during the course of the evening and he became unsteady. He started home staggering down the street and thought he better sit down and saw an open door and went in. It was a little church. The minister had been giving the flock a sermon and said, "Folks, you're all going to have to stand up to the devil sometimes and have to look him in the eye and tell him you're on the Lord's side and be of good cheer." As he said this he looks up and here's the devil himself. The minister was somewhat of a coward, and as there was an open window behind the pulpit, he bailed out into the alley and fled. He was shortly followed by the whole congregation except for one fat lady who couldn't get through the window. She goes up to the door shaking and she says, "Mr. Devil, I sure hope you let me through the door." And the devil just stares at her with his pitchfork. Then she said, "Mr. Devil, I really must get home to my husband and children." He stared at her some more and waved the pitchfork. Finally she said, "Mr. Devil, I've been a member of this church for thirty-two years and to tell you the honest-to-God's truth, I've been on your side all the time." [Laughter and applause.]

The West Against Itself, Part II

Jeffrey Ingram

The late Bernard DeVoto staved off a threat to the nation's land that was generated by what he named Congressman Barrett's Wild West Show. With the public hardly aware of what's behind it, we fear that the Show has been revived. Almost lost among the hearings on park and forest wilderness are the hearings of the Public Land Law Review Commission, which can either decimate or reënunciate a century's gains, depending upon what we and our friends have to say.

If asked to speak at a PLLRC hearing, you will be glad that you already read the gist of what the Sierra Club's Southwest Representative said at the Commission's Albuquerque hearing. Your own synthesis of what Mr. Ingram has organized will be useful wherever you speak in behalf of environment and try to separate the men from the cowboys (and miners and loggers and dam builders).

Congressman Aspinall has at times criticized the effort of the Sierra Club and others to save the Grand Canyon, wild rivers, and wilderness. His seniority also allows him to be severe with his counterpart committee in the Senate, the President, members of the Cabinet, and Mrs. Johnson too. There is also the chance that in the 90th Congress, which he has announced will be the last he will serve in, he will strive once again to help to preserve a more beautiful America, even though the economic feasibility of saving the nation's remaining beauty spots isn't too easy to discern at this moment in our history.

To a Congressman as important as he is, mail from outside his district in Colorado can be annoying. But he holds in his hands the fate of some of the best places we know, and we can help spread an understanding of their meaning. Perhaps you can try your hand. —*D.B.*

The Public Land Law Review Commission could start a rush at our land and its wealth unmatched since Paul Bunyan slew the forests.

The Public Land Law Review Commission could stand up for a land law that would help coax us toward a stable population, a progressing economy and technology, and a beautiful civilization.

The authority to choose between these two goals is the Commission's. The responsibility for which one it does choose is the public's—that is, ours.

The Public Land Law Review Commission and Its Job

The Commission, with the organization that was set up to advise it, is a tangle of special interests and bright hopes. The stated purpose is to overhaul all of the public land laws, some 5,000 of them. The Commission is dominated by people who believe in "sustained-yield" development of natural resources. These people could recommend that all public land be disposed of immediately for short-range interests; they could recommend nothing; they could do good.

The Commission is gathering information for its decisions by holding public hearings at which anyone may speak—briefly, and only if his eyes have been sharp enough to see the obscure notices announcing the time and place. The main sources of information for the Commission will be studies farmed out to universities, research organizations, and government agencies.

After the studies are finished, the Commission staff will mull over the material and then lobby the Commission to accept its conclusions. Congress will have the final say about which recommendations are accepted, but Congressmen will have to deal with an intricate mass of material with which they cannot possibly become familiar.

Given such a process, citizens find themselves a long, long way from the Commission's center; nevertheless, we must make ourselves heard on our side of conservation's great debate: shall we increase in numbers or grow in quality?

The Commission's recommendations, although covering a great range of policies, will no doubt be shaped by the side that it chooses in the great debate. This is not new; broad-gauge beliefs have always motivated our land laws. The Homestead Act captured the spirit of its time, the desire of the people to move west to find land and liberty for themselves. The Forest Management Act of 1897 resulted from the closing of the frontier, and the realization that our resources were limited and were being wasted. The Reclamation Act captured the hope that even the apparent harshness of the arid land could be made hospitable for man. The National Park Act embodied our belief that some pieces of land were of such value, as is, that they should be preserved unimpaired for all people, for all time. The spirit, if not all the letter, of the Wilderness Act reaffirmed this basic American belief in the protection of a natural heritage.

These laws, and many others, embodied some part of the spirit of our history. However, each law dealt only with a part of that vast public commitment to public ownership of lands that the Public Land Law Review Commission must deal with as a whole. The Commission will, through its recommendations, represent some part of present-day American beliefs. This unsurprising realization does not come near giving any direction to the Commission's deliberations; there are too many points of view strongly held and sincerely advocated. The uncertainty arises over which element of our national creed the Commission will emphasize, which direction in our public life it will strengthen. The Commission's choice will determine more of its final thinking than any of its studies will. Helping the Commission choose is our problem.

How Many of Us Should There Be, and Why Should the Commission Care?

Predictions, or projections as they are called by those who hedge their bets, have been made that the population of this country will be 300 million in the year 2,000. Such figures are more often than not treated as facts, as inevitable occurrences-to-come. On the basis of such projections, both governmental and private groups decide what services and goods, how much investment, will be provided. Thus a supply is promised for a demand that is only projected. In this way, people are reassured that their own, and their children's, needs in the future will be met. Historically the result of this policy has been that the demand, the population, has outstripped what was projected.

The analogy is striking between the end of the last century, when we saw that our virgin country was disappearing, and today, when we can begin to see that so long as the promised supply exceeds the projected demand, the demand will actually exceed the projection. This suggests strongly that we have never given up the idea that our resources are inexhaustible; although we do not believe any longer that virgin supplies will last forever, we have fallen into the similar delusion that our lack of knowledge about long-term biological processes and geological structures can be ignored so long as we believe in "sustained yield." Yet there are limitations on the total supply—limitations on land, on water, on air—just as there were limitations on virgin forests. If we do not accept these limitations, limitations that the studies conducted by the Commission should show, then open land, clean water, and breathable air will disappear just as most of our primeval forests have.

It does not have to happen. The Commission can work toward the end that it must not happen. It can aim at the basic problem of how much the land and its resources can supply, rather than the delusory question of how much demand there will be if there are 300 million people living in this country in 2,000. After all, the majority of those 300 million people are not yet born. The Commission does not have to accept these projections of population growth.

So, what problems do face the Commission? None is bigger than deciding what elements of the American present the public land laws should reflect into the future, what side of conservation's great debate these laws should take.

One side wants laws, and accompanying administrative practices, to promote resource development and population increase without regard to natural limits; i.e., one side wishes any projected demand to be treated as an inevitability. Of course, some later generation, trapped by the limitations that even we can begin to see, would have to abandon such laws for exceedingly restrictive ones, or else be destroyed by our own prodigality.

The other side opts for a civilization of quality, arguing that our growth can be in intangibles rather than statistics. Choosing this side would lead the Commission to recommendations for retention and minimum exploitation of the public lands, backed by the thought that this will encourage a population size permitting "the general public" actually to obtain "the maximum benefit," which is the Commission's mandate. The Commission would then be led to study specific resource problems on the premise that if supply is known to be restricted, demand will fall off.

More succinctly—and I am not joking, not even by half—the basic problem facing the Public Land Law Review Commission is birth control.

Can Communities Develop Without Using Public Lands?

Once the orientation is fixed, any large problem can be attacked in pieces, from different angles. The Commission has broken up its area of concern into a number of fields and subfields of study, some of which I would like to examine because they help define the issues in the debate.

Community development is a term with a large capacity for contradiction: development has too often meant unplanned sprawl, thus overextending the original community to the point of destroying its identity.

At an architect's convention in Santa Fe recently, someone said that the West is different from the urbanized East because out here we have huge amounts of space for expanding onto. We don't. Even if it seemed now as if our space were limitless, our consideration for future generations should lead us to think about what their point of view will be. Or just look at Los Angeles. To cope with such sprawl is hard enough; it hardly seems responsible to encourage it. Offering cities and villages public land for them to spread over at low cost would be such encouragement.

Should a piece of public land be opened up for community development when there are vacant, weed-filled lots in the city that have been leap-frogged in the rush to build subdivisions? Any municipality will be reluctant to think about orderly development and planning for quality if it knows that public land is available to it as an escape from the hard questions of what use is to occupy what space. Should public lands then become a barrier to the horizontal growth of municipalities? This is a question the answer to which would give a clear indication of the Commission's feelings, for limitation of the outer perimeter of a city may be the best way to encourage orderly planning within that city.

Can Outdoor Recreation Stand Prosperity; Can It Outlast the Bureaucracy?

The time spent on recreation is increasing faster than any other phase of national exertion. Outdoor recreation shares in the fantastic increase, but it has a special handicap—it has to fight its own success, mainly because outdoor recreation seems to demand roads.

Building, improving, then paving and widening a road through a forest or along a fishing stream always carries the sanction of satisfying demand—or "anticipated demand." Yet road-building is self-defeating in two ways. First, the construction may actually destroy a stream, for instance, or slice open a wooded hillside, exposing it to erosion. Second, as the road is improved at each stage, traffic is lured to it by the very improvement. The result too often is crowds trampling about at a spot whose claim to recreational fame has been buried under the construction debris of the road that brought them there.

Possibly education is not one of the functions of the Public Land Law Review Commission, though its purview is certainly broad. Nevertheless, it might be guided by a remark of Aldo Leopold's, that the task is "not the building of roads into lovely country, but of building receptivity into the still unlovely human mind."

The use of public lands for roads in general is only too obvious a use. The continuing tragedy of the invasions of wildlife refuges, the proposed route through the Gore Range at Red Buffalo Pass, the proposal of the Park Service to build an unneeded and disastrous road through the Great Smoky Mountains National Park, the spectacularly anti-redwood Redwood Highway "improvement"—all these should lead the Commission to question whether there are not ways of transporting people that do not so blatantly destroy the right-of-way to visual rights. I am not suggesting that the Commission take on the Department of Transportation, only that it consider whether public lands should be so open to road-builders or whether other considerations, such as preservation of wilderness, do not come first over the long run. Groups such as the Sierra Club have studied and developed criteria for roads within national parks that I hope the Commission will consider if it reaches the question of the accessibility of these areas.

In studying any aspect of the National Park System, of course, the Commission will hopefully not tamper with the great declaration of 1916: The fundamental purpose of national parks and monuments "is to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generation." It is basic that being unimpaired is essential for their future enjoyment.

To keep a place unimpaired while providing for enjoyment may require a drastic change in our approach to national sanctuaries such as parks and monuments. It may be necessary, for instance, to require reservations for such places as Yosemite National Park. If so, then the policy is better imposed now than later, with the hope that restrictions on 200 million now will make it less likely that there will be 300 million in 2,000. With no such restrictions at all, of course, there will be a larger and larger number of people coming to see less and less of an attraction.

The question of where to put park visitors when every acre is valuable for the fundamental purposes of national parks and wilderness areas is in part the problem of extensive versus intensive use of land. In Rocky Mountain National Park, there are new camping areas where the sites are tightly packed, and parking spaces just off the road. In neighboring national forest areas, on the other hand, each site occupies a sector of land all its own, and often the car or trailer is provided with a driveway. Proper management of outdoor recreational areas must lie either with cramming camping spaces all together with little intervening cover, thus leaving more country undeveloped, or with spreading the camping sites out on the theory that they are temporary homes for the visitor. Surely the latter solution is the happier one, but impossible if demand does not decrease.

The rapid increase in outdoor recreation shows itself not just in the number of people, but also in the variety of activities. Of course, the Commission cannot predict the ways that people will find to amuse themselves over the years, but it will certainly find itself involved in demands to decide how much land should be available for current activities. Rather than trying to apportion land out now, the Commission should consider having undeveloped lands placed in a reserve category, since once a piece of land is

Indoors With an Outdoor Organization

Board of Directors' meeting, February 3-4, 1968; below, Director Martin Litton

John Flannery photo

John Muir said of nature, "when we try to pick out anything by itself, we find it hitched to everything else in the universe."

PHOTOGRAPHS BY JOE MUNROE; TEXT BY BOB GOLDEN

Within the club the hitching is done with words, words whispered and words shouted, words said all at once and words waiting to be said . . .

Dick Leonard, Mike McCloskey, Lewis Clark, Ed Wayburn, Dick Sill

Ed Wayburn, Dave Brower

Charlotte Mauk, Dick Sill

Dick Sill, Peter Hearst

. . . words said in high places . . .

Top: Washington Representative Lloyd Tupling and Assistant Bob Waldrop flank Senator Thomas Kuchel. Center, left to right: Tup visits Congressman Morris Udall; Bob confers with Congressman Jeffery Cohelan; Tup talks with Ed Cliff, Chief of the U.S. Forest Service. Bottom: Tup and Bob call on Senator Henry Jackson.

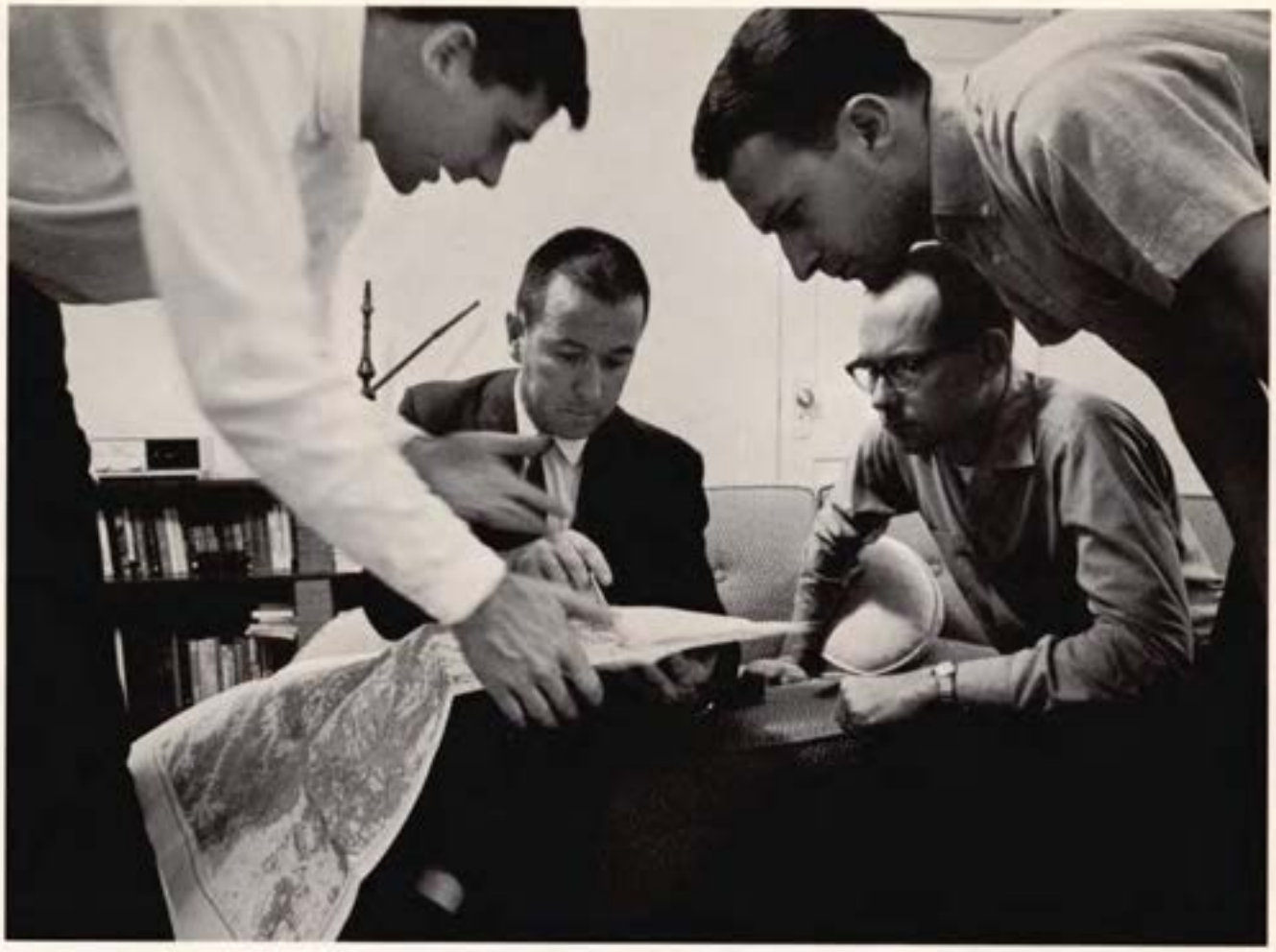
. . . words about

chapter policies . . .

. . . thousands of words about one picture, and tens of thousands more about more pictures.

Top: Executive Committee of the Atlantic Chapter meets in the New York office. Right: Executive Director Dave Brower and Hugh Barnes, President of Barnes Press, work on color plates for the book *Summer Island*. Above: Hugh and the club's Production Manager, Joe Lynn, inspect press sheets of *Baja California*.

Pat Caulfield photo



We say words about Grand Canyon and the North Cascades.

Top: Southwest Representative Jeffrey Ingram, left, studies map with members of the Save Grand Canyon League in Albuquerque. Right: Jeff in his office, a converted garage. Director Pat Goldsworthy and Northwest Representative Brock Evans discuss North Cascades park prospects.

People from San Francisco and New York, and all the places in between, read, write, listen to, and sometimes waste words.

Jane Edginton, outings

Johnnie Lacy, promotion

Mike McCloskey, Conservation Director

Gary Soucie, Atlantic Representative

Jack Schanhaar, Promotion Manager

Connie Flateboe and Hugh Nash, *Bulletin*

John Milton (see page 8)

Barbara Riley and Ron Keller, promotion

Ed Wayburn, President

Lunch meeting of staff with President Wayburn

Bob Golden, General Services Manager

Dave Brower and his secretary, Anne Chamberlain

Fred Eissler, Director

Gordon Robinson, Consultant Forester, and Dan Rosenberg, shipping room

Jane Southwell, Clair Tappaan reservations

Ken Brower (see page 3)

All because what John Muir said was right, and in our concern for nature and the world's scenic places we find ourselves hitched by talk and by letters, by people and committees, to everything else in the universe.

Top left: Anne Irving, outings; center: Linda Bufano, switchboard, receptionist Glyde Cooper, and Robin Way, Assistant to the Executive Director; right: Dan Gridley, shipping room. Bottom left: Cliff Rudden, Controller; right: Allan W. Horlin, of the London office, (working with Sierra Club books in Copenhagen).

developed for one activity, it usually cannot be easily reclaimed for another even if the demand for the latter increases faster.

One specific type of land whose status should be clarified is *de facto* wilderness. The Classification and Multiple Use Act seems to give the Bureau of Land Management and the Secretary of the Interior the right to classify wilderness on the lands under that Bureau's jurisdiction. However, the Forest Service is at present restricted to those pieces of land presently designated as Wilderness, Wild, or Primitive Areas. Since dedicating land as primeval wilderness is the one use that cannot be recovered once displaced, it seems only economical to reserve what wilderness we do have so that it will be available for the future.

Public participation in decisions on such matters would result in a greater range of alternatives being presented and a lesser degree of dissatisfaction with the result.

Bureaucracy and the Forests, by Charles A. Reich, a paper published by the Center for the Study of Democratic Institutions, raises many of the pertinent questions about the citizen's role. When, as one Park Service official noted, the only place the public can legally participate is in hearings before Congressional appropriations committees, something has gone awry.

Decision makers for the use of public lands for recreation will always be caught trying to sit on two stools, one of development, the other of preservation. I do not mean preservation to refer only to land in a wilderness area, but to apply to the desire people have to journey to a place for values which would be lost if the place were greatly altered. A dude ranch in the vicinity of forested mountains is one thing; a dude ranch in the middle of ten other dude ranches, something else. A skier will enjoy himself less if all he can see is hills full of other skiers; he needs the mountains and the trees. So do we all.

Must the Dam and Ditch School Dominate Water Development?

Outdoor recreation and community development are at opposite poles in intensity of land use. In between are the many resource uses, supplying people with the commodities thought necessary for life at any given time. The most necessary, after air, and one in which the Sierra Club has an active interest, is water. The Public Land Law Review Commission and the National Water Commission will get deeper into the water problem than I care to here. Nevertheless, the use of public lands for physical structures whose purpose is to regulate or divert or otherwise make use of water has led to some grievous conflicts and if no changes are made in the traditional policies, will lead to more.

In the past such conflicts were inevitable, for dams and levees were considered indispensable for flood control, while dams and ditches were the only means of getting water on the land. Times, technology, and ideas on these problems have all changed. Using water resources well is now largely a problem of meeting residential and industrial users' more economical, more insistent demands.

The public lands will be affected by changes in the physical apparatus for using water. Irrigation agriculture is an open cycle for the farmer. The water comes to him through a ditch from a pond impounded behind a dam. Going to his soil, most of the water would disappear for his purposes. The same is true of pumped water; the immediate source of water is different, but the same open-cycle dam-and-ditch technique obtains, and the losses are still large in proportion to the use. This technique is not suited for municipal and industrial uses; there is too much loss of a high-priced commodity, the value of which far exceeds the cost of delivering it—unlike irrigation, where the price of water is subsidized, making it economically possible for the farmer to lose most of the water through evaporation. One development which will help the city dweller is the recycling of water, cleaning it after each use so that it is available again, rather than lost in the vastness of the hydrologic cycle.

However, technological improvements cannot be allowed to obscure the question of how much water will be available for what use. In the West, the dam-and-ditch ideology has kept this question at bay, but now the dams have to be so big, the ditches so long, that a decision must be made whether the total amount of water in a given area should be increased by import from another area, or whether the water-short area ought to reconsider its water budget. Is there much irrigation, which means that most of the water is lost through evaporation and seepage? Could irrigation water be used for residential and industrial purposes, thus eliminating the need for great water imports which waste so much? Which is more beneficial to the people of the area and the nation: irrigated agriculture or industry? Underlying all, should any part of the country grow limitlessly, sucking the resources it needs to sustain that growth from the other regions, setting an example of unrestrained increase, the insanity of which would be immediately apparent if the rate of growth were extrapolated to the whole nation? We cannot move backward; Los Angeles is on the Pacific Ocean, and there it will stay even though most of its water comes from mountains and rivers far distant from it. But the fact that Los Angeles had to travel far for its present water does not imply that the Columbia River should be diverted southward so that Los Angeles can triple itself. Why should Los Angeles triple itself at all? It should not, of course, and if the Columbia is kept in the Northwest, it won't. The Public Land Law Review Commission has a responsibility to help answer these questions, not least because public lands would be flooded by the reservoirs and cut across by the ditches of any continental diversion scheme.

Flood control, too, has long been dominated by the idea of physical structures, but systems of dams and levees have one serious defect for controlling floods: they don't do the job. They do not seem able to prevent water from invading

areas people consider valuable, in part because the existence of the works encourages people to come too close and to engage in activities, such as housebuilding, which have no place on flood plains. Optimum use of the land is prevented when land is withdrawn for reservoirs that are usually not filled, and water that is trapped behind the dam drops its load of soil, thus blocking the natural renewal of land fertility. Ruin is considered in absolute terms, whereas the better approach is to allow human activities in flood plains that can stand the risk of being flooded once in a while. We too much want to exclude nature entirely; flood control would be better replaced by flood tolerance. Toward this end, the National Academy of Sciences and National Research Council report, *Alternatives in Water Management*, suggests flood-plain zoning, land-use planning, warning systems, flood insurance. These are approaches the Public Land Law Review Commission could encourage, by questioning extensive use of public land for physical flood-control methods.

Hooker dam, proposed for the upper Gila River in New Mexico, points up many of the flaws in the traditional approaches to water problems. Hooker is supposed to control floods, yet four sizable tributaries are just downstream of the site presently favored by the Bureau of Reclamation, its sponsor. The area to be aided by Hooker is not in decline or in danger of decline; it has never developed, largely because it has never been attractive for settlement. Should it be made so? Should this area be encouraged to find industries and commercial activities that would boost its economic importance? Is this the time for such development, simply because it is physically possible to build a dam and ditches there? The encouragement and pace of development, when it depends as it does here on public land and water, would seem very much the Commission's business.

Conclusion: Another Great Land Swindle or A Chance At Greatness?

The Public Land Law Review Commission is in an exposed position, continually hearing seductive calls for disposal of some or all of the public lands. Some members of the Commission and its staff would like to yield to the temptation. Like many sins, the results would likely be visited on our sons. To help keep the Commission Fathers in the path of virtue will require constant vigilance. The overt giveaway is not so much to be feared as the subtle loosening of restrictions, the slightly more advantageous treatment of a particular industry. Over all, however, is the thought that the Commission can make a positive contribution.

Many of us have had the experience of bemoaning the crowded conditions in Yosemite Valley or on Yellowstone's loop road or the Grand Canyon's south rim, and getting the smug answer that all we have to do is step off the road a few yards to be in true wilderness. This answer mistakes our whole concern, which deals with the crowds themselves. The individuals who make up those crowds are being cheated. They may not know about the cheat, but that is part of the fraud. The crowds are led to believe that they are seeing the real thing because they are not told what the real thing is. They are not educated into the variety and quality of a wilderness or a park, they are only shown a view or a sight so that they can take home a photograph proclaiming "I was there."

The Public Land Law Review Commission can also perpetrate a fraud, simply by claiming that there is enough for everybody for always. All the Commission has to do is point toward the obvious resource uses and neglect the possibility that, if educated, we would see the necessity and reward of intense use of what we are now using, reclamation of what we have discarded, and reservation of what we have not yet touched. That is, the Commission can orient its recommendations toward achieving a more stable population, which would thus be able to learn about and acquire the intangibles that make living more than massive drudgery and unrelieved tragedy.

We can aim in this direction, for we are, and will be, rich enough. The question is whether we are energetic enough to restrict the increase in the numbers of our people. The question is whether the Commission will be strong enough to recommend public land laws which will encourage intensive use and quality management of already-opened land, letting the rest lie unexploited. The Commission can frame laws that are statements of what is best in us today, so that we can hope that what we see as good, that what we have to struggle for now, will be cherished, protected, and carried on by our children.

> *. . . do we not already sing our love for and obligations to the land of the free and the home of the brave? Yes, but just what and whom do we love? Certainly not the soil, which we are sending helter-skelter downriver. Certainly not the rivers, which we assume have no function except to turn turbines, float barges, and carry off sewage. Certainly not the plants, of which we exterminate whole communities without batting an eye. Certainly not the animals, of which we have already extirpated many of the largest and most beautiful species. A land ethic of course cannot prevent the alteration, management, and use of these 'resources,' but it does affirm their right to continued existence, and, at least in spots, their continued existence in a natural state.*
>
> —Aldo Leopold

At a meeting of the American Association for the Advancement of Science, Professor White of U.C.L.A.'s History Department marshalled evidence that Western theology supports Western technology's assault on the environment

Historical Roots of Our Ecological Crisis

LYNN WHITE, JR.

A CONVERSATION with Aldous Huxley not infrequently put one at the receiving end of an unforgettable monologue. About a year before his lamented death, he was discoursing on a favorite topic: man's unnatural treatment of nature and its sad results. To illustrate his point he told how, during the previous summer, he had returned to a little valley in England where he had spent many happy months as a child. Once it had been composed of delightful grassy glades; now it was becoming overgrown with unsightly brush because the rabbits that formerly kept such growths under control had largely succumbed to a disease, myxomatosis, that was deliberately introduced by the local farmers to reduce the rabbits' destruction of crops. Being something of a Philistine, I could be silent no longer, even in the interests of great rhetoric. I interrupted to point out that the rabbit itself had been brought as a domestic animal to England in 1176, presumably to improve the protein diet of the peasantry.

All forms of life modify their contexts. The most spectacular instance is doubtless the coral polyp. Ever since man became a numerous species, he has affected his environment notably. The hypothesis that his fire-drive method of hunting created the world's greatest grasslands and helped to exterminate the monster mammals of the Pleistocene from much of the globe, is plausible, if not proved. For six millenia at least, the banks of the lower Nile have been a human artifact rather than the swampy African jungle which nature apart from man would have made it. The Aswan Dam, flooding 5,000 square miles, is only the latest stage in a long process. In many regions terracing or irrigation, overgrazing, the cutting of forests by Romans to build ships to fight Carthaginians or by Crusaders to solve the logistic problems of their expeditions, have profoundly changed some ecologies. Observations that the French landscape falls into two basic types, the open fields of the north and the *bocage* of the south and west, inspired Marc Bloch to undertake his classic study of medieval agricultural methods. Quite unintentionally, changes in human ways often affect nonhuman nature. It has been noted, for example, that the advent of the automobile eliminated the huge flocks of sparrows that once fed on the horse manure littering every street.

The history of ecologic change is still so rudimentary that we know little about what really happened, or what the results were. The extinction of the European aurochs as late as 1627 would seem to have been a simple case of overenthusiastic hunting. On more intricate matters it often is impossible to find solid information. For a thousand years or more the Frisians and Hollanders have been pushing back the North Sea, and the process is culminating in our own time with the reclamation of the Zuider Zee. What, if any, species of animals, birds, fish, shore life, or plants have died out in the process? In their epic combat with Neptune, have the Netherlanders overlooked ecological values in such a way that the quality of human life in the Netherlands has suffered? I cannot discover that the questions have ever been asked, much less answered.

People, then, have often been a dynamic element in their own environment, but in the present state of historical scholarship we usually do not know exactly when, where, or with what effects man-induced changes came. As we enter the last third of the Twentieth Century, however, concern for the problem of ecologic backlash is mounting feverishly. Natural science, conceived as the effort to understand the nature of things, had flourished in several eras and among several peoples. Similarly there had been an age-old accumulation of technological skills, sometimes growing rapidly, sometimes slowly. But it was not until about four generations ago that Western Europe and North America arranged a marriage between science and technology, a union of the theoretical and the empirical approaches to our natural environment. The emergence in widespread practice of the Baconian creed that scientific knowledge means technological power over nature can scarcely be dated before about 1850, save in the chemical industries where it is anticipated in the Eighteenth Century. Its acceptance as a normal pattern of action may mark the greatest event in human history since the invention of agriculture, and perhaps in nonhuman terrestrial history as well.

Almost at once the new situation forced the crystallization of the novel concept of ecology; indeed, the word *ecology* first appeared in the English language in 1873. Today, less than a century later, the impact of our race upon the environment has so increased in force that it has changed in essence. When the first cannons were fired in the early

Fourteenth Century, they affected ecology by sending workers scrambling to the forests and mountains for more potash, sulfur, iron ore and charcoal, with some resulting erosion and deforestation. Hydrogen bombs are of a different order: a war fought with them might alter the genetics of all life on this planet. By 1285 London had a smog problem arising from the burning of soft coal; but our present combusion of fossil fuels threatens to change the chemistry of the globe's atmosphere as a whole, with consequences which we are only beginning to guess. With the population explosion, the carcinoma of planless urbanism, the now geological deposits of sewage and garbage, surely no creature other than man has ever managed to foul its nest in such short order.

There are many calls to action, but specific proposals, however worthy as individual items, seem too partial, palliative, negative: ban the bomb, tear down the billboards, give the Hindus contraceptives and tell them to eat their sacred cows. The simplest solution to any suspect change is, of course, to stop it, or, better yet, to revert to a romanticized past: make those ugly gasoline stations look like Anne Hathaway's cottage or (in the Far West) like ghost-town saloons. The "wilderness area" mentality invariably advocates deep-freezing an ecology, whether San Gimignano or the High Sierra, as it was before the first Kleenex was dropped. But neither atavism nor prettification will cope with the ecologic crisis of our time.

What shall we do? No one yet knows. Unless we think about fundamentals, our specific measures may produce new backlashes more serious than those that they are designed to remedy.

As a beginning we should try to clarify our thinking by looking, in some historical depth, at the presuppositions that underlie modern technology and science. Science was traditionally aristocratic, speculative, intellectual in intent; technology was lower-class, empirical, action-oriented. The quite sudden fusion of these two, towards the middle of the Nineteenth Century, is surely related to the slightly prior and contemporary democratic revolutions which, by reducing social barriers, tended to assert a functional unity of brain and hand. Our ecologic crisis is the product of an emerging, entirely novel, democratic culture. The issue is whether a democratized world can survive its own implications. Presumably we cannot unless we rethink our axioms.

Western Science and Technology

One thing is so certain that it seems stupid to verbalize it: both modern technology and modern science are distinctively *Occidental*. Our technology has absorbed elements from all over the world, notably from China; yet everywhere today, whether in Japan or in Nigeria, successful technology is Western. Our science is the heir to all the sciences of the past, especially perhaps of the work of the great Islamic scientists of the Middle Ages who so often outdid the ancient Greeks in skill and perspicacity: al Rāzī in medicine, for example; or ibn al-Haitam in optics; or Omar Khayyam in mathematics. Indeed, not a few works of such geniuses seem to have vanished in the original Arabic and to survive only in medieval Latin translations that helped to lay the foundations for later Western developments. Today, around the globe, all significant science is Western in style and method whatever the pigmentation or language of the scientists.

A second pair of facts is less well recognized because they result from quite recent historical scholarship. The leadership of the West both in technology and in science is far older than the so-called Scientific Revolution of the Seventeenth Century or the so-called Industrial Revolution of the Eighteenth Century. These terms are in fact outmoded, and obscure the true nature of what they try to describe: i.e., significant stages in two long and separate developments. By 1000 A.D. at latest—and perhaps, feebly, as much as two hundred years earlier—the West began to apply water power to industrial processes other than milling grain. This was followed in the later Twelfth Century by the harnessing of wind power. From simple beginnings, but with remarkable consistency of style, the West rapidly expanded its skills in power machinery, labor-saving devices and automation. Those who doubt should contemplate that most monumental achievement in the history of automation: the weight-driven mechanical clock which appeared in two forms in the early Fourteenth Century. Not in craftsmanship, but in basic technological capacity, the Latin West of the later Middle Ages far outstripped its elaborate, sophisticated and esthetically magnificent sister cultures, Byzantium and Islam. In 1444 a great Greek ecclesiastic, Bessarion, who had gone to Italy, wrote a letter to a prince in Greece. He is amazed by the superiority of Western ships, arms, textiles, glass. But above all he is astonished by the spectacle of waterwheels sawing timbers and pumping the bellows of blast furnaces. Clearly, he had seen nothing of the sort in the Near East.

By the end of the Fifteenth Century the technological preponderance of Europe was such that its small, mutually hostile nations could spill out over all the rest of the world, conquering, looting and colonizing. The symbol of this technical superiority is the fact that Portugal, one of the weakest states of the Occident, was able to become and to remain for a century mistress of the East Indies. And we must remember that the technology of Vasco da Gama and Albuquerque was built by pure empiricism, drawing remarkably little support or inspiration from science.

In the present-day vernacular understanding, modern science is supposed to have begun in 1543 when both Copernicus and Vesalius published their great works. It is no derogation of their accomplishments, however, to point out that such structures as the *Fabrica* and the *De revolutionibus* do not appear overnight. The distinctive Western tradition of science, in fact, began in the later Eleventh Century with a massive movement of translation of Arabic and Greek scientific works into Latin. A few notable books—

Theophrastus, for example—escaped the West's avid new appetite for science, but within less than two hundred years effectively the entire corpus of Greek and Muslim science was available in Latin, and was being eagerly read and criticized in the new European universities. Out of criticism arose new observation, speculation and increasing distrust of ancient authorities. By the latter Thirteenth Century, Europe had seized global scientific leadership from the faltering hands of Islam. It would be as absurd to deny profound originality to Newton, Galileo or Copernicus as to deny it to Fourteenth Century scholastic scientists like Buridan or Oresme on whose work they built. Before the Eleventh Century, science scarcely existed in the Latin West, even in Roman times. From the Eleventh Century onward, the scientific sector of Occidental culture has increased in a steady crescendo.

Since both our technological and our scientific movements got their start, acquired their character, and achieved world dominance in the Middle Ages, it would seem that we cannot understand their nature or their present impact upon ecology without examining fundamental medieval assumptions and developments.

Christian Theology and Western Science

Until recently, agriculture has been the chief occupation even in "advanced" societies; hence, any change in methods of tillage has much importance. Early plows, drawn by two oxen, did not normally turn the sod, but merely scratched it. Thus cross-plowing was needed and fields tended to be squarish. In the fairly light soils and semi-arid climates of the Near East and Mediterranean, this worked well. But such a plow was inappropriate to the wet climate and often sticky soils of Northern Europe. By the later Seventh Century after Christ, however, following obscure beginnings, certain northern peasants were using an entirely new kind of plow, equipped with a vertical knife to cut the line of the furrow, a horizontal share to slice under the sod, and a moldboard to turn it over. The friction of this plow with the soil was so great that it normally required not two but eight oxen. It attacked the land with such violence that crossplowing was not needed, and fields tended to be shaped in long strips.

In the days of the scratch-plow, fields were distributed generally in units capable of supporting a single family. The assumption was subsistence farming. But no peasant owned eight oxen; to use the new and more efficient plow, peasants pooled their oxen to form large plow-teams, originally receiving (it would appear) plowed strips in proportion to their contribution. Thus distribution of land was no longer based on the needs of a family but rather on the capacity of a power-machine to till the earth. Man's relation to the soil was profoundly changed. Formerly man had been part of nature; now he was the exploiter of nature. Nowhere else in the world did farmers develop any analogous agricultural implement. Is it coincidence that modern technogoly, with its ruthlessness towards nature, has so largely been produced by descendants of these peasants of Northern Europe?

This same exploitative attitude appears slightly before 830 A.D. in western illustrated calendars. In older calendars the months were shown as passive personifications. The new Frankish calendars, which set the style for the Middle Ages, are very different: they show men coercing the world around them—plowing, harvesting, chopping trees, butchering pigs. Man and nature are two things, and man is master.

These novelties seem to be in harmony with larger intellectual patterns. What people do about their ecology depends on what they think about themselves in relation to things around them. Human ecology is deeply conditioned by beliefs about our nature and destiny, that is, by religion. To Western eyes this is very evident in, say, India or Ceylon. It is equally true of ourselves and of our medieval ancestors.

The victory of Christianity over paganism was the greatest psychic revolution in the history of our culture. It has become fashionable today to say that, for better or worse, we live in "the post-Christian age." Certainly the forms of our thinking and language have largely ceased to be Christian, but to my eye the substance often remains amazingly akin to that of the past. Our daily habits of action, for example, are dominated by an implicit faith in perpetual progress which was unknown either to Greco-Roman antiquity or to the Orient. It is rooted in, and is indefensible apart from, Judeo-Christian teleology. The fact that Communists share it merely helps to show what can be demonstrated on many other grounds: that Marxism, like Islam, is a Judeo-Christian heresy. We continue today to live as we have lived for about 1700 years, very largely in a context of Christian axioms.

What did Christianity tell people about their relations with the environment?

While many of the world's mythologies provide stories of creation, Greco-Roman mythology was singularly incoherent in this respect. Like Aristotle, the intellectuals of the ancient West denied that the visible world had had a beginning. Indeed, the idea of a beginning was impossible in the framework of their cyclical notion of time. In sharp contrast, Christianity inherited from Judaism not only a concept of time as nonrepetitive and linear, but also a striking story of creation. By gradual stages a living and all-powerful God had created light and darkness, the heavenly bodies, the earth and all its plants, animals, birds, and fishes. Finally, God had created Adam—and as an afterthought, Eve, to keep man from being lonely. Man named all the animals, thus establishing his dominance over them. God planned all of this explicitly for man's benefit and rule: no item in the physical creation had any purpose save to serve man's purposes. And, although man's body is made of clay, he is not simply part of nature: he is made in God's image.

Especially in its Western form, Christianity is the most

anthropocentric religion that the world has seen. As early as the Second Century both Tertullian and St. Irenseus of Lyons were insisting that when God shaped Adam he was foreshadowing the image of the incarnate Christ, the Second Adam. Man shares, in great measure, God's transcendence of nature. Christianity, in absolute contrast to ancient paganism and Asia's religions (except perhaps Zoroastrianism), not only established a dualism of man and nature but also insisted that it is God's will that man exploit nature for his proper ends.

At the level of the common people this worked out in an interesting way. In Antiquity every tree, every spring, every stream, every hill had its own *genius loci*, its guardian spirit. These spirits were accessible to men, but were very unlike man: centaurs, fauns, and mermaids show their ambivalence. Before one cut a tree, mined a mountain or dammed a brook, it was important to placate the spirit in charge of that particular situation, and keep it placated. By destroying pagan animism, Christianity made it possible to exploit nature in a mood of indifference to the feelings of natural objects.

It is often said that for animism the Church substituted the cult of saints. True; but the cult of saints is functionally quite different from animism. The saint is not *in* natural objects; he may have special shrines, but his citizenship is in heaven. Moreover, a saint is entirely a man; he can be approached in human terms. In addition to saints, Christianity of course also had angels and demons inherited from Judaism and perhaps, at one remove, from Zoroastrianism. But these were all as mobile as the saints themselves. The spirits *in* natural objects, which formerly had protected nature from man, evaporated. Man's effective monopoly on spirit in this world was confirmed and the old inhibitions to the exploitation of nature crumbled.

When one speaks in such sweeping terms, a note of caution is in order. Christianity is a complex faith, and its consequences differ in differing contexts. What I have said may well apply to the medieval West where in fact technology made spectacular advances. But the Greek East, a highly civilized realm of equal Christian devotion, seems to have produced no marked technological innovation after the later Seventh Century when Greek fire was invented. The key to the contrast may perhaps be found in a difference in the tonality of piety and thought which students of comparative theology find between the Greek and the Latin Churches. The Greeks believed that sin was intellectual blindness and that salvation was found in illumination, orthodoxy, i.e., clear thinking. The Latins, on the other hand, felt that sin was moral evil, and salvation was to be found in right conduct. Eastern theology has been intellectualist. Western theology has been voluntarist. The Greek saint contemplates; the Western saint acts. The implications of Christianity for the conquest of nature would emerge more easily in the Western atmosphere.

The Christian dogma of creation, which is found in the first clause of all the Creeds, has another meaning for our comprehension of today's ecologic crisis. By revelation, God had given to man the Bible, the Book of Scripture. But since God had made nature, nature also must reveal the divine mentality. The religious study of nature for the better understanding of God was known as natural theology. In the early Church, and always in the Greek East, nature was conceived primarily as a symbolic system through which God speaks to men: the ant is a sermon to sluggards; rising flames are the symbol of the soul's aspiration. This view of nature was essentially artistic rather than scientific. While Byzantium preserved and copied great numbers of ancient Greek scientific texts, science as we conceive it could scarcely flourish in such an ambience.

In the Latin West however, natural theology was following a very different bent by the early Thirteenth Century. It was ceasing to be the decoding of the physical symbols of God's communication with man and was becoming the effort to understand God's mind by discovering how His creation operates. The rainbow was no longer simply a symbol of hope first sent to Noah after the Deluge: Robert Grosseteste, Friar Roger Bacon and Theodoric of Freilberg produced startlingly sophisticated work on the optics of the rainbow, but they did it as a venture in religious understanding. From the Thirteenth Century onward, up to and including Leibniz and Newton, every major scientist, in effect, explained his motivations in religious terms. Indeed, if Galileo had not been so expert an amateur theologian he would have got into far less trouble: the professionals resented his intrusion. And Newton seems to have regarded himself more as a theologian than as a scientist. It was not until the later Eighteenth Century that the hypothesis of God became unnecessary to many scientists.

It is often hard for the historian to judge, when men explain why they are doing what they want to do, whether they are offering real reasons or merely culturally acceptable reasons. The consistency with which scientists during the long formative centuries of Western science said that the task and the reward of the scientist was "to think God's thoughts after him," leads one to believe that this was their real motivation. If so, then modern Western science was cast in a matrix of Christian theology. The dynamism of religious devotion, shaped by the Judeo-Christian dogma of creation, gave it impetus.

Christianity and the Ecologic Backlash

We would seem to be headed towards conclusions unpalatable to many Christians. Since both *science* and *technology* are blessed words in our contemporary vocabulary, some may be happy at the notions, first, that viewed historically, modern science is an extrapolation of natural theology, and, second, that modern technology is at least partly to be explained as an Occidental, voluntarist realization of the Christian dogma of man's transcendence of, and rightful mastery over, nature. But, as we now recognize, somewhat over a century ago science and technology—hitherto quite separate activities—joined to give mankind

powers which, to judge by many of the ecologic effects, are out of control. If so, Christianity bears a huge burden of guilt.

I personally doubt that disastrous ecologic backlash can be avoided simply by applying to our problems more science and more technology. Our science and technology have grown out of Christian attitudes towards man's relation to nature which are almost universally held not only by Christians and neo-Christians but also by those who fondly regard themselves as post-Christians. Despite Copernicus, all the cosmos rotates around our little globe. Despite Darwin, we are *not*, in our hearts, part of the natural process. We are superior to nature, contemptuous of it, willing to use it for our slightest whim. The newly elected Governor of California, like myself a churchman but less troubled than I, spoke for the Christian tradition when he is alleged to have said, "When you've seen one redwood tree, you've seen them all." To a Christian a tree can be no more than a physical fact. The whole concept of the sacred grove is alien to Christianity and to the ethos of the West. For nearly two millennia Christian missionaries have been chopping down sacred groves, which are idolatrous because they assume spirit in nature.

What we do about ecology depends on our ideas of the man-nature relationship. More science and more technology are not going to get us out of the present ecologic crisis until we find a new religion, or rethink our old one. The beatniks, who are the basic revolutionaries of our time, show a sound instinct in their affinity for Zen Buddhism, which conceives of the man-nature relationship as very nearly the mirror image of the Christian view. Zen, however, is as deeply conditioned by Asian history as Christianity is by the experience of the West, and I am dubious of its viability among us.

Possibly we should ponder the greatest radical in Christian history since Christ: St. Francis of Assisi. It is a miracle that Francis did not end at the stake, as many of his left-wing followers did. He was so clearly heretical that a General of the Franciscan Order, St. Bonaventura, a great and perceptive Christian, tried to suppress the early accounts of Franciscanism. The key to understanding Francis is the virtue of humility not merely for the individual but for man as a species. He tried to depose man from his monarchy over creation and set up a democracy of all of God's creatures. With him the ant is no longer simply a homily for the lazy, flames a sign of the thrust of the soul towards union with God: now they are Brother Ant and Sister Fire, praising the Creator in their own ways as Brother Man does in his.

Later commentators have said that Francis preached to the birds as a rebuke to men who would not listen. The records do not read so: he urged the little birds to praise God, and in spiritual ecstacy they flapped their wings and chirped rejoicing. Legends of saints, especially the Irish saints, had long told of their dealings with animals, but always, I believe, to show their human dominance over creatures. With Francis it is different. The land around Gubbio in the Apennines was being ravaged by a fierce wolf. St. Francis, says the legend, talked to the wolf and persuaded him of the error of his ways. The wolf repented, died in the odor of sanctity, and was buried in consecrated ground.

What Sir Steven Runciman calls "the Franciscan doctrine of the animal soul" was quickly stamped out. Quite possibly it was derived, consciously or unconsciously, from the belief in reincarnation held by the Cathar heretics who at that time teemed in Italy and Southern France, and who presumably had got it from India. It is significant that at just the same moment, about 1200, traces of metempsychosis are found also in western Judaism, in the Provencal *Cabbala*.

I am not suggesting that many contemporary Americans who are concerned about our ecologic crisis will be either able or willing to counsel with wolves or exhort birds. However, the present increasing disruption of the global environment is the product of a dynamic technology and science which were originating in the Western medieval world against which St. Francis was rebelling in so original a way. Their growth cannot be understood historically apart from distinctive attitudes toward nature which are deeply grounded in Christian dogma. The fact that most people do not think of these attitudes as Christian is irrelevant. No new set of basic values has been accepted in our society to displace those of Christianity. Hence we shall continue to have a worsening ecologic crisis until we reject the Christian axiom that nature has no reason for existence save to serve man.

The greatest spiritual revolutionary in Western history, St. Francis, proposed what he thought was an alternate Christian view of nature and man's relation to it: he tried to substitute the idea of the equality of all creatures, including man, for the idea of man's limitless rule of creation. Both our present science and our present technology are so tinctured with Christian arrogance toward nature that no solution for our ecologic crisis can be expected from them alone. Since the roots of our trouble are so largely religious, the remedy must also be essentially religious, whether we call it that or not. We must rethink and refeel our nature and destiny. The profoundly religious, but heretical, sense of the primitive Franciscans for the spiritual autonomy of all parts of nature may point a direction. I propose Francis as a patron saint for ecologists.

Ascending the Riffelberg

We were casting about for a way to give up gracefully—and we found it. What we are giving up, in the Sierra Club's seventy-fifth year, is all the articles that might have come to the SCB *about mountaineering, but will go instead —and it's all right—to* ASCENT, the Sierra Club Mountaineering Journal, *Volume One Number One of which we hope you will already have subscribed to. It will cover contemporary mountaineering much better than the* Bulletin *can.*

We give up not only gracefully, but also cleverly. We have ourselves obtained an unusual article on mountaineering by an author our internecine rival, ASCENT, *cannot touch. We therefore present the following climbing account as an* SCB *scoop. The article should prove quite helpful to members who plan to tramp innocently abroad in Europe this coming summer. It has a special pertinence here, antedating by thirteen years as it does Volume One Number One of the* SCB.

I SAT SILENT some time, then turned to Harris and said: "My mind is made up."

Something in my tone struck him; and when he glanced at my eye and read what was written there, his face paled perceptibly. He hesitated a moment, then said:

"Speak."

I answered, with perfect calmness:

"I WILL ASCEND THE RIFFELBERG."

If I had shot my poor friend he could not have fallen from his chair more suddenly. If I had been his father he could not have pleaded harder to get me to give up my purpose. But I turned a deaf ear to all he said. When he perceived at last that nothing could alter my determination, he ceased to urge, and for a while the deep silence was broken only by his sobs. I sat in marble resolution, with my eyes fixed upon vacancy, for in spirit I was already wrestling with the perils of the mountains, and my friend sat gazing at me in adoring admiration through his tears. At last he threw himself upon me in a loving embrace and exclaimed in broken tones:

"Your Harris will never desert you. We will die together!"

I cheered the noble fellow with praises, and soon his fears were forgotten and he was eager for the adventure. He wanted to summon the guides at once and leave at two in the morning, as he supposed the custom was; but I explained that nobody was looking at that hour; and that the start in the dark was not usually made from the village but from the first night's resting-place on the mountainside. I said we would leave the village at 3 or 4 P.M. on the morrow; meantime he could notify the guides, and also let the public know of the attempt which we proposed to make.

I went to bed, but not to sleep. No man can sleep when he is about to undertake one of these Alpine exploits. I tossed feverishly all night long, and was glad enough when I heard the clock strike half past eleven and knew it was time to get up for dinner. I rose, jaded and rusty, and went to the noon meal, where I found myself the center of interest and curiosity; for the news was already abroad. It is not easy to eat calmly when you are a lion, but it is very pleasant, nevertheless.

As usual, at Zermatt, when a great ascent is about to be undertaken, everybody, native and foreign, laid aside his own projects and took up a good position to observe the start. The expedition consisted of 198 persons, including the mules; or 205, including the cows.

It was full four o'clock in the afternoon before my cavalcade was entirely ready. At that hour it began to move. In point of numbers and spectacular effect, it was the most imposing expedition that had ever marched from Zermatt.

I commanded the chief guide to arrange the men and animals in single file, twelve feet apart, and lash them all together on a strong rope. He objected that the first two miles was a dead level, with plenty of room, and that the rope was never used except in very dangerous places. But I would not listen to that. My reading had taught me that many serious accidents had happened in the Alps simply from not having the people tied up soon enough; I was not going to add one to the list. The guide then obeyed my order.

When the procession stood at ease, roped together, and ready to move, I never saw a finer sight. It was 3,122 feet long—over half a mile; every man but Harris and me was on foot, and had on his green veil and his blue goggles, and his white rag around his hat, and his coil of rope over one shoulder and under the other, and his ice-ax in his belt, and carried his alpenstock in his left hand, his umbrella (closed) in his right, and his crutches slung at his back. The burdens of the pack-mules and the horns of the cows were decked with the Edelweiss and the Alpine rose.

I and my agent were the only persons mounted. We were in the post of danger in the extreme rear, and tied securely to five guides apiece. Our armor-bearers carried our ice-axes, alpenstocks, and other implements for us. We were mounted upon very small donkeys, as a measure of safety; in time of peril we could straighten our legs and stand up, and let the donkey walk from under. Still, I cannot recommend this sort of animal—at least for excursions of mere pleasure—because his ears interrupt the view. I and my agent possessed the regulation mountaineering costumes, but concluded to leave them behind. Out of respect for the great numbers of tourists of both sexes who would be assembled in front of the hotels to see us pass, and also out of respect for the many tourists whom we expected to encounter on our expedition, we decided to make the ascent in evening dress.

At fifteen minutes past four I gave the command to move, and my subordinates passed it along the line. The great crowd in front of the Monte Rosa hotel parted in twain, with a cheer, as the procession approached; and as the head of it was filing by I gave the order—"Unlimber—make ready—HOIST!"—and with one impulse up went my half-mile of umbrellas. It was a beautiful sight, and a total surprise to the spectators. Nothing like that had ever been seen in the Alps before. The applause it brought forth was deeply gratifying to me, and I rode by with my plug hat in my hand to testify my appreciation of it. It was the only testimony I could offer, for I was too full to speak.

We watered the caravan at the cold stream which rushes down a trough near the end of the village, and soon afterward left the haunts of civilization behind us. About half past five o'clock we arrived at a bridge which spans the Visp, and after throwing over a detachment to see if it was safe, the caravan crossed without accident. The way now led, by a gentle ascent, carpeted with fresh green grass, to the church at Winkelmatten. Without stopping to examine this edifice, I executed a flank movement to the right and crossed the bridge over the Findelenbach, after first testing its strength. Here I deployed to the right again, and presently entered an inviting stretch of meadowland which was unoccupied save by a couple of deserted huts toward its furthest extremity. These meadows offered an excellent camping-place. We pitched our tents, supped, established a proper guard, recorded the events of the day, and then went to bed.

WE ROSE at two in the morning and dressed by candlelight. It was a dismal and chilly business. A few stars were shining, but the general heavens were overcast, and the great shaft of the Matterhorn was draped in a sable pall of clouds. The chief guide advised a delay; he said he feared it was going to rain. We waited until nine o'clock, and then got away in tolerably clear weather.

Our course led up some terrific steeps, densely wooded with larches and cedars, and traversed by paths which the rains had guttered and which were obstructed by loose stones. To add to the danger and inconvenience, we were constantly meeting returning tourists on foot or horseback, and as constantly being crowded and battered by ascending tourists who were in a hurry and wanted to get by.

Our troubles thickened. About the middle of the afternoon the seventeen guides called a halt and held a consultation. After consulting an hour they said their first suspicion remained intact—that is to say, they believed they were lost. I asked if they did not *know* it? No, they said, they *couldn't* absolutely know whether they were lost or not, because none of them had ever been in that part of the country before. They had a strong instinct that they were lost, but they had no proofs—except that they did not know where they were. They had met no tourists for some time, and they considered that a suspicious sign.

Plainly we were in an ugly fix. The guides were naturally unwilling to go alone and seek a way out of the difficulty; so we all went together. For better security we moved slow and cautiously, for the forest was very dense. We did not move up the mountain, but around it, hoping to strike across the old trail. Toward nightfall, when we were about tired out, we came up against a rock as big as a cottage. This barrier took all the remaining spirit out of the men, and a panic of fear and despair ensued. They moaned and wept, and said they should never see their homes and their dear ones again. Then they began to upbraid me for bringing them upon this fatal expedition. Some even muttered threats against me.

Clearly it was no time to show weakness. So I made a

speech in which I said that other Alp-climbers had been in as perilous a position as this, and yet by courage and perseverance had escaped. I promised to stand by them, I promised to rescue them. I closed by saying we had plenty of provisions to maintain us for quite a siege—and did they suppose Zermatt would allow half a mile of men and mules to mysteriously disappear during any considerable time, right above their noses, and make no inquiries? No, Zermatt would send out searching-expeditions and we should be saved.

This speech had a great effect. The men pitched the tents with some little show of cheerfulness, and we were snugly under cover when the night shut down. I now reaped the reward of my wisdom in providing one article which is not mentioned in any book of Alpine adventure but this. I refer to the paregoric. But for that beneficent drug, not one of those men would have slept a moment during that fearful night. But for that gentle persuader they must have tossed, unsoothed, the night through; for the whisky was for me. Yes, they would have risen in the morning unfitted for their heavy task. As it was, everybody slept but my agent and me—only we two and the barkeepers. I would not permit myself to sleep at such a time. I considered myself responsible for all those lives. I meant to be on hand and ready, in case of avalanches. I am aware, now, that there were no avalanches up there, but I did not know it then.

We watched the weather all through that awful night, and kept an eye on the barometer, to be prepared for the least change. There was not the slightest change recorded by the instrument, during the whole time. Words cannot describe the comfort that that friendly, hopeful, steadfast thing was to me in that season of trouble. It was a defective barometer, and had no hand but the stationary brass pointer, but I did not know that until afterward. If I should be in such a situation again, I should not wish for any barometer but that one.

All hands rose at two in the morning and took breakfast, and as soon as it was light we roped ourselves together and went at that rock. For some time we tried the hook-rope and other means of scaling it, but without success—that is, without perfect success. The hook caught once, and Harris started up it hand over hand, but the hold broke and if there had not happened to be a chaplain sitting underneath at the time, Harris would certainly have been crippled. As it was, it was the chaplain. He took to his crutches, and I ordered the hook-rope to be laid aside. It was too dangerous an implement where so many people were standing around.

We were puzzled for a while; then somebody thought of the ladders. One of these was leaned against the rock, and the men went up it tied together in couples. Another ladder was sent up for use in descending. At the end of half an hour everybody was over, and that rock was conquered. We gave our first grand shout of triumph. But the joy was short-lived, for somebody asked how we were going to get the animals over.

This was a serious difficulty; in fact, it was an impossibility. The courage of the men began to waver immediately; once more we were threatened with a panic. But when the danger was most imminent, we were saved in a mysterious way. A mule which had attracted attention from the beginning by its disposition to experiment, tried to eat a five-pound can of nitroglycerin. This happened right alongside the rock. The explosion threw us all to the ground, and covered us with dirt and debris; it frightened us extremely, too, for the crash it made was deafening, and the violence of the shock made the ground tremble. However, we were grateful, for the rock was gone. Its place was occupied by a new cellar, about thirty feet across, by fifteen feet deep. The explosion was heard as far as Zermatt; and an hour and a half afterwards, many citizens of that town were knocked down and quite seriously injured by descending portions of mule meat, frozen solid. This shows, better than any estimate in figures, how high the experimenter went.

We had nothing to do, now, but bridge the cellar and proceed on our way. With a cheer the men went at their work. I attended to the engineering, myself. I appointed a strong detail to cut down trees with ice-axes and trim them for piers to support the bridge. This was a slow business, for ice-axes are not good to cut wood with. I caused my piers to be firmly set up in ranks in the cellar, and upon them I laid six of my forty-foot ladders, side by side, and laid six more on top of them. Upon this bridge I caused a bed of boughs to be spread, and on top of the boughs a bed of earth six inches deep. I stretched ropes upon either side to serve as railings, and then my bridge was complete. A train of elephants could have crossed it in safety and comfort. By nightfall the caravan was on the other side and the ladders taken up.

NEXT MORNING we went on in good spirits for a while, though our way was slow and difficult, by reason of the steep and rocky nature of the ground and the thickness of the forest; but at last a dull despondency crept into the men's faces and it was apparent that not only they, but even the guides, were now convinced that we were lost. The fact that we still met no tourists was a circumstance that was but too significant. Another thing seemed to suggest that we were not only lost, but very badly lost; for there must surely be searching-parties on the road before this time, yet we had seen no sign of them.

Demoralization was spreading; something must be done, and done quickly, too. Fortunately, I am not unfertile in expedients. I contrived one now which commended itself to all, for it promised well. I took three-quarters of a mile of rope and fastened one end of it around the waist of a guide, and told him to go and find the road, while the caravan waited. I instructed him to guide himself back by the rope, in case of failure; in case of success, he was to give the rope a series of violent jerks, whereupon the Expedition would go

to him at once. He departed, and in two minutes had disappeared among the trees. I payed out the rope myself, while everybody watched the crawling thing with eager eyes. The rope crept away quite slowly, at times, at other times with some briskness. Twice or thrice we seemed to get the signal, and a shout was just ready to break from the men's lips when they perceived it was a false alarm. But at last, when over half a mile of rope had slidden away, it stopped gliding and stood absolutely still—one minute—two minutes—three—while we held our breath and watched.

Was the guide resting? Was he scanning the country from some high point? Was he inquiring of a chance mountaineer? Stop—had he fainted from excess of fatigue and anxiety?

This thought gave us a shock. I was in the very act of detailing an Expedition to succor him, when the cord was assailed with a series of such frantic jerks that I could hardly keep hold of it. The huzza that went up, then, was good to hear. "Saved! saved!" was the word that rang out, all down the long rank of the caravan.

We rose up and started at once. We found the route to be good enough for a while, but it began to grow difficult, by and by, and this feature steadily increased. When we judged we had gone half a mile, we momentarily expected to see the guide; but no, he was not visible anywhere; neither was he waiting, for the rope was still moving, consequently he was doing the same. This argued that he had not found the road, yet, but was marching to it with some peasant. There was nothing for us to do but plod along—and this we did. At the end of three hours we were still plodding. This was not only mysterious, but exasperating. And very fatiguing, too; for we had tried hard, along at first, to catch up with the guide, but had only fagged ourselves, in vain; for although he was traveling slowly he was yet able to go faster than the hampered caravan over such ground.

At three in the afternoon we were nearly dead with exhaustion—and still the rope was slowly gliding out. The murmurs against the guide had been growing steadily, and at last they were become loud and savage. A mutiny ensued. The men refused to proceed. They declared that we had been traveling over and over the same ground all day, in a kind of circle. They demanded that our end of the rope be made fast to a tree, so as to halt the guide until we could overtake him and kill him. This was not an unreasonable requirement, so I gave the order.

As soon as the rope was tied, the Expedition moved forward with that alacrity which the thirst for vengeance usually inspires. But after a tiresome march of almost half a mile, we came to a hill covered thick with a crumbly rubbish of stones, and so steep that no man of us all was now in a condition to climb it. Every attempt failed, and ended in crippling somebody. Within twenty minutes I had five men on crutches. Whenever a climber tried to assist himself by the rope, it yielded and let him tumble backward. The frequency of this result suggested an idea to me. I ordered the caravan to 'bout face and form in marching order; I then made the tow-rope fast to the rear mule, and gave the command:

"Mark time—by the right flank—forward march!"

The procession began to move, to the impressive strains of a battle-chant, and I said to myself, "Now, if the rope don't break I judge *this* will fetch that guide into the camp." I watched the rope gliding down the hill, and presently when I was all fixed for triumph I was confronted by a bitter disappointment; there was no guide tied to the rope, it was only a very indignant old black ram. The fury of the baffled Expedition exceeded all bounds. They even wanted to wreak their unreasoning vengeance on this innocent dumb brute. But I stood between them and their prey, menaced by a bristling wall of ice-axes and alpenstock, and proclaimed that there was but one road to this murder, and it was directly over my corse. Even as I spoke I saw that my doom was sealed, except a miracle supervened to divert these madmen from their fell purpose. I see that sickening wall of weapons now; I see that advancing host as I saw it then, I see the hate in those cruel eyes; I remember how I drooped my head upon my breast, I feel again the sudden earthquake shock in my rear, administered by the very ram I was sacrificing myself to save; I hear once more the typhoon of laughter that burst from the assaulting column as I clove it from van to rear like a Sepoy shot from a Rodman gun.

I was saved. Yes, I was saved, and by the merciful instinct of ingratitude which nature had planted in the breast of that treacherous beast. The grace which eloquence had failed to work in those men's hearts, had been wrought by a laugh. The ram was set free and my life was spared.

We lived to find out that that guide had deserted us as soon as he had placed a half-mile between himself and us. To avert suspicion, he had judged it best that the line should continue to move; so he caught that ram, and at the time that he was sitting on it making the rope fast to it, we were imagining that he was lying in a swoon, overcome by fatigue and distress. When he allowed the ram to get up it fell to plunging around, trying to rid itself of the rope, and this was the signal which we had risen up with glad shouts to obey. We had followed this ram round and round in a circle all day—a thing which was proven by the discovery that we had watered the Expedition seven times at one and the same spring in seven hours. As expert a woodman as I am, I had somehow failed to notice this until my attention was called to it by a hog. This hog was always wallowing there, and as he was the only hog we saw, his frequent repetition, together with his unvarying similarity to himself, finally caused me to reflect that he must be the same hog, and this led me to the deduction that this must be the same spring, too—which indeed it was.

I made a note of this curious thing, as showing in a striking manner the relative difference between glacial action and the action of the hog. It is now a well-established fact that glaciers move; I consider that my observations go to show, with equal conclusiveness, that a hog in a spring does

not move. I shall be glad to receive the opinions of other observers upon this point.

To return, for an explanatory moment, to that guide, and then I shall be done with him. After leaving the ram tied to the rope, he had wandered at large a while, and then happened to run across a cow. Judging that a cow would naturally know more than a guide, he took her by the tail, and the result justified his judgment. She nibbled her leisurely way downhill till it was near milking-time, then she struck for home and towed him into Zermatt.

We went into camp on that wild spot to which that ram had brought us. The men were greatly fatigued. Their conviction that we were lost was forgotten in the cheer of a good supper, and before the reaction had a chance to set in, I loaded them up with paregoric and put them to bed.

Next morning I was considering in my mind our desperate situation and trying to think of a remedy, when Harris came to me with a Baedeker map which showed conclusively that the mountain we were on was still in Switzerland—yes, every part of it was in Switzerland. So we were not lost, after all. This was an immense relief; it lifted the weight of two such mountains from my breast. I immediately had the news disseminated and the map exhibited. The effect was wonderful. As soon as the men saw with their own eyes that they knew where they were, and that it was only the summit that was lost and not themselves, they cheered up instantly and said with one accord, let the summit take care of itself, they were not interested in its troubles.

Our distress being at an end, I now determined to rest the men in camp and give the scientific department of the Expedition a chance. First, I made a barometric observation, to get our altitude, but I could not perceive that there was any result. I knew, by my scientific reading, that either thermometers or barometers ought to be boiled, to make them accurate; I did not know which it was, so I boiled both. There was still no result; so I examined these instruments and discovered that they possessed radical blemishes: the barometer had no hand but the brass pointer and the ball of the thermometer was stuffed with tin-foil. I might have boiled those things to rags, and never found out anything.

I hunted up another barometer; it was new and perfect. I boiled it half an hour in a pot of bean soup which the cooks were making. The result was unexpected: the instrument was not affected at all, but there was such a strong barometer taste to the soup that the head cook, who was a most conscientious person, changed its name in the bill of fare. The dish was so greatly liked by all, that I ordered the cook to have barometer soup every day. It was believed that the barometer might eventually be injured, but I did not care for that. I had demonstrated to my satisfaction that it could not tell how high a mountain was, therefore I had no real use for it. Changes of the weather I could take care of without it; I did not wish to know when the weather was going to be good, what I wanted to know was when it was going to be bad, and this I could find out from Harris' corns. Harris had had his corns tested and regulated at the government observatory in Heidelberg, and one could depend upon them with confidence. So I transferred the new barometer to the cooking department, to be used for the official mess. It was found that even a pretty fair article of soup could be made with the defective barometer; so I allowed that one to be transferred to the subordinate messes.

I next boiled the thermometer, and got a most excellent result; the mercury went up to about 200° Fahrenheit. In the opinion of the other scientists of the Expedition, this seemed to indicate that we had attained the extraordinary altitude of two hundred thousand feet above sea-level. Science places the line of eternal snow at about ten thousand feet above sea-level. There was no snow where we were, consequently it was proven that the eternal snow-line ceases somewhere above the ten-thousand-foot level and does not begin any more. This was an interesting fact, and one which had not been observed by any observer before. It was as valuable as interesting, too, since it would open up the deserted summits of the highest Alps to population and agriculture. It was a proud thing to be where we were, yet it caused us a pang to reflect that but for that ram we might just as well have been two hundred thousand feet higher.

The success of my last experiment induced me to try an experiment with my photographic apparatus. I got it out, and boiled one of my cameras, but the thing was a failure: it made the wood swell up and burst, but I could not see that the lenses were any better than they were before.

I now concluded to boil a guide. It might improve him, it could not impair his usefulness. But I was not allowed to proceed. Guides have no feeling for science, and this one would not consent to be made uncomfortable in its interest.

In the midst of my scientific work, one of those needless accidents happened which are always occurring among the ignorant and thoughtless. A porter shot at a chamois and missed it and crippled the Latinist. This was not a serious matter to me, for a Latinist's duties are as well performed on crutches as otherwise—but the fact remained that if the Latinist had not happened to be in the way a mule would have got that load. That would have been quite another matter, for when it comes down to a question of value there is a palpable difference between a Latinist and a mule. I could not depend on having a Latinist in the right place every time; so, to make things safe, I ordered that in the future the chamois must not be hunted within limits of the camp with any other weapon than the forefinger.

My nerves had hardly grown quiet after this affair when they got another shake-up—one which utterly unmanned me for a moment: a rumor swept suddenly through the camp that one of the barkeepers had fallen over a precipice!

However, it turned out that it was only a chaplain. I had

laid in an extra force of chaplains, purposely to be prepared for emergencies like this, but by some unaccountable oversight had come away rather short-handed in the matter of barkeepers.

On the following morning we moved on, well refreshed and in good spirits. I remember this day with peculiar pleasure, because it saw our road restored to us. Yes, we found our road again, and in quite an extraordinary way. We had plodded along some two hours and a half, when we came up against a solid mass of rock about twenty feet high. I did not need to be instructed by a mule this time. I was already beginning to know more than any mule in the Expedition. I at once put in a blast of dynamite, and lifted that rock out of the way. But to my surprise and mortification, I found that there had been a chalet on top of it.

I picked up such members of the family as fell in my vicinity, and subordinates of my corps collected the rest. None of these poor people were injured, happily, but they were much annoyed. I explained to the head chaleteer just how the thing happened, and that I was only searching for the road, and would certainly have given him timely notice if I had known he was up there. I said I had meant no harm, and hoped I had not lowered myself in his estimation by raising him a few rods in the air. I said many other judicious things, and finally when I offered to rebuild his chalet, and pay for the breakages, and throw in the cellar, he was mollified and satisfied. He hadn't any cellar at all, before; he would not have as good a view, now, as formerly, but what he had lost in view he had gained in cellar, by exact measurement. He said there wasn't another hole like that in the mountains—and he would have been right if the late mule had not tried to eat up the nitroglycerin.

I put a hundred and sixteen men at work, and they rebuilt the chalet from its own debris in fifteen minutes. It was a good deal more picturesque than it was before, too. The man said we were now on the Feli-Stutz, above the Schwegmatt—information which I was glad to get, since it gave us our position to a degree of particularity which we had not been accustomed to for a day or so. We also learned that we were standing at the foot of the Riffelberg proper, and that the initial chapter of our work was completed.

We had a fine view, from here, of the energetic Visp, as it makes its first plunge into the world from under a huge arch of solid ice, worn through the foot-wall of the great Gorner Glacier; and we could also see the Furggenbach, which is the outlet of the Furggen Glacier.

The mule-road to the summit of the Riffelberg passed right in front of the chalet, a circumstance which we almost immediately noticed, because a procession of tourists was filing along it pretty much all the time. The chaleteer's business consisted in furnishing refreshments to tourists. My blast had interrupted this trade for a few minutes, by breaking all the bottles on the place; but I gave the man a lot of whisky to sell for Alpine champagne, and a lot of vinegar which would answer for Rhine wine, consequently trade was soon as brisk as ever.

I FORMED the caravan in marching order, presently, and after riding down the line to see that it was properly roped together, gave the command to proceed. In a little while the road carried us to open, grassy land. We were above the troublesome forest, now, and had an uninterrupted view, straight before us, of our summit—the summit of the Riffelberg.

We followed the mule-road, a zigzag course, now to the right, now to the left, but always up, and always crowded and incommoded by going and coming files of reckless tourists who were never, in a single instance, tied together. I was obliged to exert the utmost care and caution, for in many places the road was not two yards wide, and often the lower side of it sloped away in slanting precipices eight and even nine feet deep. I had to encourage the men constantly, to keep them from giving way to their unmanly fears.

We might have made the summit before night, but for a delay caused by the loss of an umbrella. I was for allowing the umbrella to remain lost, but the men murmured, and with reason, for in this exposed region we stood in peculiar need of protection against avalanches; so I went into camp and detached a strong party to go after the missing article.

The difficulties of the next morning were severe, but our courage was high, for our goal was near. At noon we conquered the last impediment—we stood at last upon the summit, and without the loss of a single man except the mule that ate the glycerin. Our great achievement was achieved—the possibility of the impossible was demonstrated, and Harris and I walked proudly into the great dining-room of the Riffelberg Hotel and stood our alpenstocks up in the corner.

Yes, I had made the grand ascent; but it was a mistake to do it in evening dress. The plug hats were battered, the swallow-tails were fluttering rags, mud added no grace, the general effect was unpleasant and even disreputable.

There were about seventy-five tourists at the hotel—mainly ladies and little children—and they gave us an admiring welcome which paid us for all our privations and sufferings. The ascent had been made, and the names and dates now stand recorded on a stone monument there to prove it to all future tourists.

I boiled a thermometer and took an altitude, with a most curious result: *the summit was not as high as the point on the mountainside where I had taken the first altitude.* Suspecting that I had made an important discovery, I prepared to verify it. There happened to be a still higher summit (called the Gorner Grat), above the hotel, and notwithstanding the fact that it overlooks a glacier from a dizzy height, and that the ascent is difficult and dangerous, I resolved to venture up there and boil a thermometer. So I sent a strong party, with some borrowed hoes, in charge of two chiefs of service, to dig a stairway in the soil all the way, and this I ascended, roped to the guides. This breezy height was the summit proper—so I accomplished even

more than I had originally purposed to do. This foolhardy exploit is recorded on another stone monument.

I boiled my thermometer, and sure enough, this spot, which purported to be two thousand feet higher than the locality of the hotel, turned out to be nine thousand feet *lower*. Thus the fact was clearly demonstrated, that, *above a certain point, the higher a point seems to be, the lower it actually is*. Our ascent itself was a great achievement, but this contribution to science was an inconceivably greater matter.

Cavilers object that water boils at a lower and lower temperature the higher and higher you go, and hence the apparent anomaly. I answer that I do not base my theory upon what the boiling water does, but upon what a boiled thermometer says. You can't go behind the thermometer.

I had a magnificent view of Monte Rosa, and apparently all the rest of the Alpine world, from that high place. All the circling horizon was piled high with a mighty tumult of snowy crests. One might have imagined he saw before him the tented camps of a beleaguering host of Brobdingnagians.

But lonely, conspicuous, and superb, rose that wonderful upright wedge, the Matterhorn. Its precipitous sides were powdered over with snow, and the upper half hidden in thick clouds which now and then dissolved to cobweb films and gave brief glimpses of the imposing tower as through a veil. A little later the Matterhorn took to himself the semblance of a volcano; he was stripped naked to his apex—around this circled vast wreaths of white cloud which strung slowly out and streamed away slantwise toward the sun, a twenty-mile stretch of rolling and tumbling vapor, and looking just as if it were pouring out of a crater. Later again, one of the mountain's sides was clean and clear, and another side densely clothed from base to summit in thick smoke-like cloud which feathered off and blew around the shaft's sharp edge like the smoke around the corners of a burning building. The Matterhorn is always experimenting, and always gets up fine effects, too. In the sunset, when all the lower world is palled in gloom, it points toward heaven out of the pervading blackness like a finger of fire. In the sunrise—well, they say it is very fine in the sunrise.

Authorities agree that there is no such tremendous "lay-out" of snowy Alpine magnitude, grandeur, and sublimity to be seen from any other accessible point as the tourist may see from the summit of the Riffelberg. Therefore, let the tourist rope himself up and go there; for I have shown that with nerve, caution, and judgment, the thing can be done.

I WISH to add one remark, here—in parentheses, so to speak—suggested by the word "snowy," which I have just used. We have all seen hills and mountains and levels with snow on them, and so think we know all the aspects and effects produced by snow. But indeed we do not until we have seen the Alps. Possibly mass and distance add something—at any rate, something *is* added. Among other noticeable things, there is a dazzling, intense whiteness about the distant Alpine snow, when the sun is on it, which one recognizes as peculiar, and not familiar to the eye. The snow which one is accustomed to has a tint to it—painters usually give it a bluish cast—but there is no perceptible tint to the distant Alpine snow when it is trying to look its whitest. As to the unimaginable splendor of it when the sun is blazing on it—well, it simply *is* unimaginable.

A guide-book is a queer thing. The reader has just seen what a man who undertakes the great ascent from Zermatt to the Riffelberg Hotel must experience. Yet Baedeker makes these strange statements concerning the matter:

1. Distance—3 hours.
2. The road cannot be mistaken.
3. Guide unnecessary.
4. Distance from Riffelberg Hotel to the Gorner Grat, one hour and a half.
5. Ascent simple and easy. Guide unnecessary.
6. Elevation of Zermatt above sea-level, 5,315 feet.
7. Elevation of Riffelberg Hotel above sea level, 8,429 feet.
8. Elevation of the Gorner Grat above sea-level, 10,289 feet.

I have pretty effectually throttled these errors by sending him the following demonstrated facts:

1. Distance from Zermatt to Riffelberg Hotel, 7 days.
2. The road *can* be mistaken. If I am the first that did it, I want the credit of it, too.
3. Guides *are* necessary, for none but a native can read those finger-boards.
4. The estimate of the elevation of the several localities above sea-level is pretty correct—for Baedeker. He only misses it about a hundred and eighty or ninety thousand feet.

I found my arnica invaluable. My men were suffering excruciatingly from the friction of sitting down so much. During two or three days, not one of them was able to do more than lie down or walk about; yet so effective was the arnica, that on the fourth all were able to sit up. I consider that, more than to anything else, I owe the success of our great undertaking to arnica and paregoric.

My men being restored to health and strength, my main perplexity, now, was how to get them down the mountain again. I was not willing to expose the brave fellows to the perils, fatigues, and hardships of that fearful route again if it could be helped. First I thought of balloons; but, of course, I had to give that idea up, for balloons were not procurable. I though of several other expedients, but upon consideration discarded them, for cause. But at last I hit it. I was aware that the movement of glaciers is an established fact, for I had read it in Baedeker; so I resolved to take passage for Zermatt on the great Gorner Glacier.

Very good. The next thing was, how to get down to the glacier comfortably—for the mule-road to it was long, and

winding, and wearisome. I set my mind at work, and soon thought out a plan. One looks straight down upon the vast frozen river called the Gorner Glacier, from the Gorner Grat, a sheer precipice twelve hundred feet high. We had one hundred and fifty-four umbrellas—and what is an umbrella but a parachute?

I mentioned this noble idea to Harris, with enthusiasm, and was about to order the Expedition to form on the Gorner Grat, with their umbrellas, and prepare for flight by platoons, each platoon in command of a guide, when Harris stopped me and urged me not to be too hasty. He asked me if this method of descending the Alps had ever been tried before. I said no, I had not heard of an instance. Then, in his opinion, it was a matter of considerable gravity; in his opinion it would not be well to send the whole command over the cliff at once; a better way would be to send down a single individual, first, and see how he fared.

I saw the wisdom of this idea instantly. I said as much, and thanked my agent cordially, and told him to take his umbrella and try the thing right away, and wave his hat when he got down, if he struck in a soft place, and then I would ship the rest right along.

Harris was greatly touched with this mark of confidence, and said so, in a voice that had a perceptible tremble in it; but at the same time he said he did not feel himself worthy of so conspicuous a favor; that it might cause jealousy in the command, for there were plenty who would not hesitate to say he had used underhanded means to get the appointment, whereas his conscience would bear him witness that he had not sought it at all, nor even, in his secret heart, desired it.

I said these words did him extreme credit, but that he must not throw away the imperishable distinction of being the first man to descend an Alp per parachute, simply to save the feelings of some envious underlings. No, I said, he *must* accept the appointment—it was no longer an invitation, it was a command.

He thanked me with effusion, and said that putting the thing in this form removed every objection. He retired, and soon returned with his umbrella, his eyes flaming with gratitude and his cheeks pallid with joy. Just then the head guide passed along. Harris's expression changed to one of infinite tenderness, and he said:

"That man did me a cruel injury four days ago, and I said in my heart he should live to perceive and confess that the only noble revenge a man can take upon his enemy is to return good for evil. I resign in his favor. Appoint him."

I threw my arms around the generous fellow and said:

"Harris, you are the noblest soul that lives. You shall not regret this sublime act, neither shall the world fail to know of it. You shall have opportunities for transcending this one, too, if I live—remember that."

I called the head guide to me and appointed him on the spot. But the thing aroused no enthusiasm in him. He did not take to the idea at all. He said:

"Tie myself to an umbrella and jump over the Gorner Grat! Excuse me, there are a great many pleasanter roads to the devil than that."

Upon a discussion of the subject with him, it appeared that he considered the project distinctly and decidedly dangerous. I was not convinced, yet I was not willing to try the experiment in any risky way—that is, in a way that might cripple the strength and efficiency of the Expedition. I was about at my wits' end when it occurred to me to try it on the Latinist.

He was called in. But he declined, on the plea of inexperience, diffidence in public, lack of curiosity, and I don't know what all. Another man declined on account of a cold in the head; thought he ought to avoid exposure. Another could not jump well—never *could* jump well—did not believe he could jump so far without long and patient practice. Another was afraid it was going to rain, and his umbrella had a hole in it. Everybody had an excuse. The result was what the reader has by this time guessed: the most magnificent idea that was ever conceived had to be abandoned, from sheer lack of a person with enterprise enough to carry it out. Yes, I actually had to give that thing up—while doubtless I should live to see somebody use it and take all the credit from me.

WELL, I had to go overland—there was no other way. I marched the Expedition down the steep and tedious mule-path and took up as good a position as I could upon the middle of the glacier—because Baedeker said the middle part travels the fastest. As a measure of economy, however, I put some of the heavier baggage on the shoreward parts, to go as slow freight.

I waited and waited, but the glacier did not move. Night was coming on, the darkness began to gather—still we did not budge. It occurred to me then, that there might be a time-table in Baedeker; it would be well to find out the hours of starting. I called for the book—it could not be found. Bradshaw would certainly contain a time-table; but no Bradshaw could be found.

Very well, I must make the best of the situation. So I pitched the tents, picketed the animals, milked the cows, had supper, paregoricked the men, established the watch, and went to bed—with orders to call me as soon as we came in sight of Zermatt.

I awoke about half past ten next morning, and looked around. We hadn't budged a peg! At first I could not understand it; then it occurred to me that the old thing must be aground. So I cut down some trees and rigged a spar on the starboard and another on the port side, and fooled away upward of three hours trying to spar her off. But it was no use. She was half a mile wide and fifteen or twenty miles long, and there was no telling just whereabouts she *was* aground. The men began to show uneasiness, too, and presently they came flying to me with ashy faces, saying she had sprung a leak.

Nothing but my cool behavior at this critical time saved us from another panic. I ordered them to show me the place. They led me to a spot where a huge boulder lay in a deep pool of clear and brilliant water. It did look like a pretty bad leak, but I kept that to myself. I made a pump and set the men to work to pump out the glacier. We made a success of it. I perceived, then, that it was not a leak at all. This boulder had descended from a precipice and stopped on the ice in the middle of the glacier, and the sun had warmed it up, every day, and consequently it had melted its way deeper and deeper into the ice, until at last it reposed, as we had found it, in a deep pool of the clearest and coldest water.

Presently Baedeker was found again, and I hunted eagerly for the time-table. There was none. The book simply said the glacier was moving all the time. This was satisfactory, so I shut up the book and chose a good position to view the scenery as we passed along. I stood there some time enjoying the trip, but at last it occurred to me that we did not seem to be gaining any on the scenery. I said to myself, "This confounded old thing's aground again, sure,"—and opened Baedeker to see if I could run across any remedy for these annoying interruptions. I soon found a sentence which threw a dazzling light upon the matter. It said, "The Gorner Glacier travels at an average rate of a little less than an inch a day." I have seldom felt so outraged. I have seldom had my confidence so wantonly betrayed. I made a small calculation: One inch a day, say thirty feet a year; estimated distance to Zermatt, three and one-eighteenth miles. Time required to go by glacier, *a little over five hundred years!* I said to myself, "I can *walk* it quicker—and before I will patronize such a fraud as this, I will do it."

When I revealed to Harris the fact that the passenger part of this glacier—the central part—the lightning-express part, so to speak—was not due in Zermatt till the summer of 2378, and that the baggage, coming along the slow edge, would not arrive until some generations later, he burst out with:

"That is European management, all over! An inch a day— think of that! Five hundred years to go a trifle over three miles! But I am not a bit surprised. It's a Catholic glacier. You can tell by the look of it. And the management."

I said, no, I believed nothing but the extreme end of it was in a Catholic canton.

"Well, then, it's a government glacier," said Harris. "It's all the same. Over here the government runs everything—so everything's slow; slow, and ill-managed. But with us, everything's done by private enterprise—and then there ain't much lolling around, you can depend on it. I wish Tom Scott could get his hands on this torpid old slab once—you'd see it take a different gait from this."

I said I was sure he would increase the speed, if there was trade enough to justify it.

"He'd *make* trade," said Harris. "That's the difference between governments and individuals. Governments don't care, individuals do. Tom Scott would take all the trade; in two years Gorner stock would go to two hundred, and inside of two more you would see all the other glaciers under the hammer for taxes." After a reflective pause, Harris added, "A little less than an inch a day; a little less than an *inch*, mind you. Well, I'm losing my reverence for glaciers."

I was feeling much the same way myself. I have traveled by canal-boat, ox-wagon, raft, and by the Ephesus and Smyrna railway; but when it comes to good solid honest slow motion, I bet my money on the glacier. As a means of passenger transportation, I consider the glacier a failure; but as a vehicle for slow freight, I think she fills the bill. In the matter of putting the fine shades on that line of business, I judge she could teach the Germans something.

I ordered the men to break camp and prepare for the land journey to Zermatt. At this moment a most interesting find was made; a dark object, bedded in the glacial ice, was cut out with the ice-axes, and it proved to be a piece of the undressed skin of some animal—a hair trunk, perhaps; but a close inspection disabled the hair-trunk theory, and further discussion and examination exploded it entirely—that is, in the opinion of all the scientists except the one who had advanced it. This one clung to his theory with the affectionate fidelity characteristic of originators of scientific theories, and afterward won many of the first scientists of the age to his view, by a very able pamphlet which he wrote, entitled, "Evidences going to show that the hair trunk, in a wild state, belonged to the early glacial period, and roamed the wastes of chaos in company with the cave-bear, primeval man, and the other Oölitics of the Old Silurian family."

Each of our scientists had a theory of his own, and put forward an animal of his own as a candidate for the skin. I sided with the geologist of the Expedition in the belief that this patch of skin had once helped to cover a Siberian elephant, in some old forgotten age—but we divided there, the geologist believing that this discovery proved that Siberia had formerly been located where Switzerland is now, whereas I held the opinion that it merely proved that the primeval Swiss was not the dull savage he is represented to have been, but was a being of high intellectual development, who like to go to the menagerie.

We arrived that evening, after many hardships and adventures, in some fields close to the great ice-arch where the mad Visp boils and surges out from under the foot of the great Gorner Glacier, and here we camped, our perils over and our magnificent undertaking successfully completed. We marched into Zermatt the next day, and were received with the most lavish honors and applause. A document, signed and sealed by all the authorities, was given to me which established and indorsed the fact that I had made the ascent of the Riffelberg. This I wear around my neck, and it will be buried with me when I am no more.

—Mark Twain

January, 1963, the waters of Lake Powell started to rise behind Glen Canyon Dam, one of a long series of dams the Bureau of Reclamation plans to build on the Colorado. The drowning of Glen Canyon began. Few people ever knew much about Glen Canyon. No one else will ever again know what it was like.

Its early inhabitants looked upon the graceful curves of a tree-lined, living river. Now, the trees are going under, the curves vanish; the river is stilled, and a vast expanse of water rises. . . .

All the spectacular canyons are going under. Lake Powell is filling them to their brims. Its shores will usually be up on the plateaus. The few canyons that will remain are the upstream ones that were not even run-of-the-mill Glen Canyon spectacular. . . .

As the waters rose to cover the bars and the canyon floor, the animals retreated to higher and higher ground; then to the bushes and grass, in order to escape the flood. Beaver swam back and forth trying to find something familiar. Many animals drowned.

The cool streams and casual walking are gone. The glens that gave the canyon its name are permanently lost. . . .

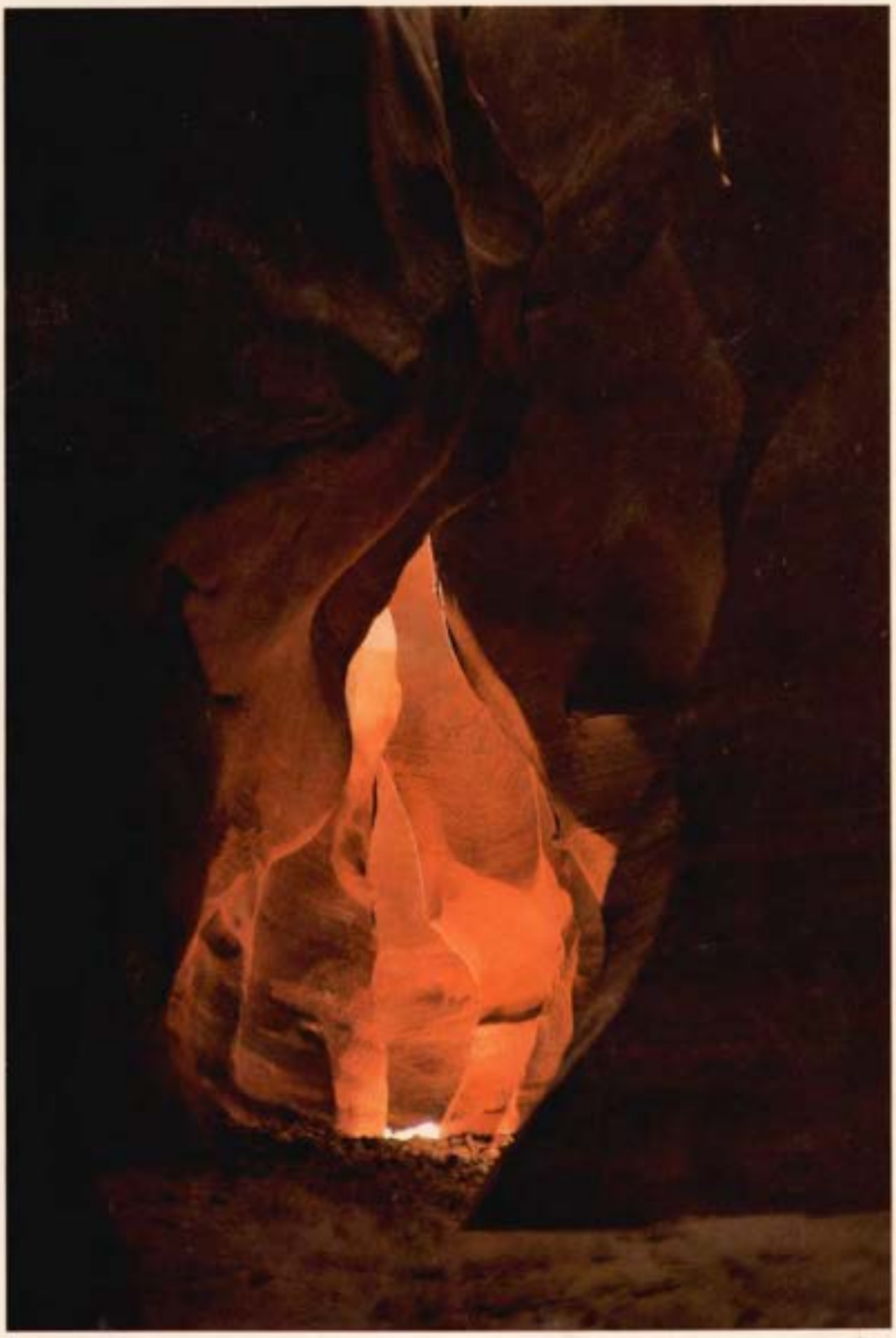
The waters rise, and the towering buttes of Navajo-land become visible as you speed above where the river was. Powell, before it fills and drops, will probably be the most beautiful reservoir in the world, even though the best has gone under. Publicity will draw crowds, who will never realize what they have lost. . . .

The fate of Glen Canyon is also the fate planned for most of the still-living Colorado River—even for Grand Canyon. . . .

Remember things lost:

The chance to float quietly down a calm river, to let the current reveal a thousand years of history, the wild heritage that belonged in Glen, a canyon itself alive. Incredible, haunting beauty, where the creations of the Colorado rivaled any in the world, where the side canyons simply had no rivals. We lost wholeness, integrity, in a place no one knew well enough, a place that might always have let people know how magnificent a gesture is the natural world.

—from the soundtrack of *Glen Canyon*



PHIL PENNINGTON: Glen Canyon

. . . but how beautiful it is.

—ROBINSON JEFFERS

There was no sculpture like this and now there is none.
Remember these things lost.