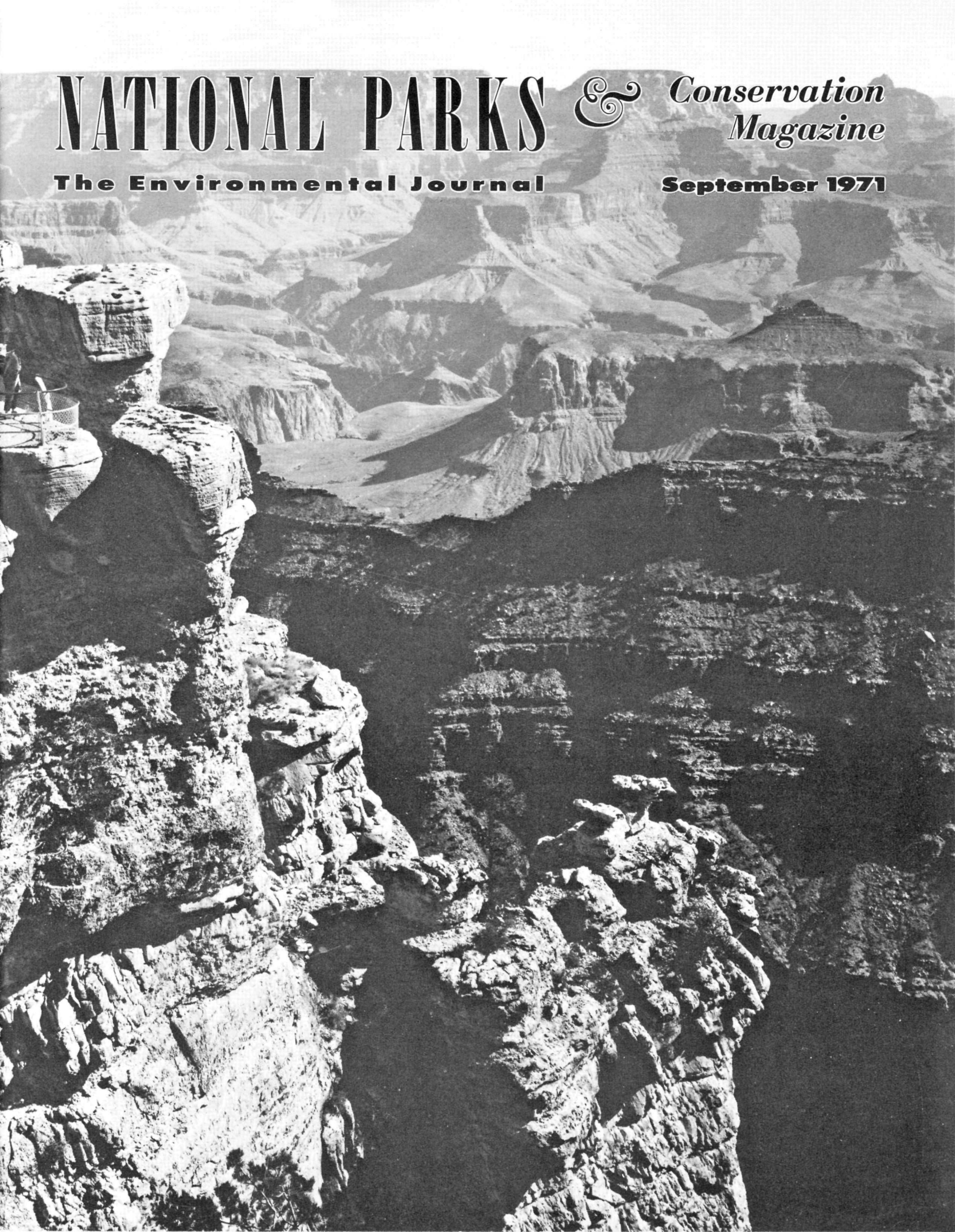

NATIONAL PARKS & *Conservation Magazine*

The Environmental Journal

September 1971

THE HUMAN ENVIRONMENT

PREPARATIONS for the United Nations Conference on the Human Environment which will be held at Stockholm in Sweden in June 1972 are well under way.

The general management of the Conference is the responsibility of Under Secretary General Maurice F. Strong of Canada. Special officers are in charge of the work at United Nations headquarters in New York and Geneva.

Participation by the United States is the responsibility of Christian L. Herter, Jr., Special Assistant to the Secretary of State for Environmental Affairs. Environmentalists and humanitarians all over the world must wish these public officials all possible success in their vitally important undertaking.

It has been said before, but it needs to be repeated often, that the present world crisis is a crisis of all life on earth. The next half century will bring important breakthroughs in world control over the perilous armaments race and over the disintegration of the human environment, or human life on this planet, perhaps all life, may well come to an abrupt end.

This is not alarmism; complacency is the great danger; intelligent and courageous persons first face the facts; only then can they devise measures to cope with the facts.

Secretary General U Thant set the purposes of the Environmental Conference in a broad framework in his announcement last year. He made it clear that protection and restoration of the natural environment were involved; but that grave social problems like overpopulation and overurbanization were so closely related to those of the natural environment that none of them could be separated from the others.

There seems to be some danger that a polarity will develop between the industrial countries and the agricultural countries at Stockholm. The industrial countries are deeply concerned with environmental problems as a result of the disastrous impact of a mismanaged technology in those nations. The agricultural countries, looking toward increased agricultural production, and toward industrialization, may be inclined to minimize the dangers of pollution, or in any event to insist that the industrial countries pick up the price tag for the internalization or mitigation of the environmental costs of development.

One regrettable result of this possible polarization might be a tendency on the part of the planners of the conference to pull the agenda back into very narrow environmental issues, not involving serious economic or fiscal problems.

Ecology and economics cannot be separated. Economic development which impairs the ecological foundations of life, including human life, will be self-defeating; in a very narrow but practical sense it will be counter-productive in terms of development.

Economic development throughout the world must proceed on ecological premises; the industrial countries and the agricultural countries alike must cooperate in seeing that it does so. The Conference on the Environment should be so organized and its program should be so planned as to make sure that this breadth of approach is established and maintained.

We are aware, of course, that the Conference on the Environment will be followed by a Conference on the Law of the Sea in 1973, and that the latter will be commissioned to examine all marine environmental problems with a hope of arriving at a comprehensive treaty with broad international participation, establishing inter-governmental machinery under the United Nations for managing marine resources in the interest of humanity.

But the Conference on the Environment dare not limit its own discussions, conclusions, and recommendations to an unduly narrow field. In deference to the subsequent meeting, it is essential that the planners of both meetings work together to move along as rapidly as possible, with an examination

Continued on page 35

National Parks & Conservation Magazine is published monthly. Contributed manuscripts and photographs are welcome. They should be addressed to the Editor at Association headquarters and should be accompanied by a stamped, self-addressed envelope. No responsibility can be assumed for unsolicited material. As an organization receiving tax-exempt contributions, gifts, and bequests, the Association is precluded by law from advocating or opposing legislation to any substantial extent. Insofar as authors of articles published in this magazine may touch on legislation, they write as individuals.

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COVER *Grand Canyon from Mather Point by Ed Cooper*
Grand Canyon is one of 34 national parks and monuments in the vicinity of a network of coal-fueled power plants being built in the Four Corners area of the Southwest. The environmental health of the entire area is seriously threatened by the power projects, as Bob Ashton Jr. describes beginning on page 4.

BACK COVER *Grassy Lake in the John Muir Wilderness by L. J. Prater, U.S. Forest Service*

National Parks & Conservation Association, established in 1919 by Stephen Mather, the first Director of the National Park Service, is an independent, private, nonprofit, public service organization, educational and scientific in character. Its responsibilities relate primarily to protecting the national parks and monuments of America, in which it endeavors to cooperate with the National Park Service while functioning as a constructive critic, and to protecting and restoring the whole environment. Life memberships are $500. Annual membership dues, including subscription to National Parks & Conservation Magazine, are: $100 sustaining, $50 supporting, $15 contributing, and $10 associate. Student memberships are $8. Single copies are $1. Contributions and bequests are needed to carry on our work. Dues in excess of $10 and contributions are deductible from federal taxable income, and gifts and bequests are deductible for federal gift and estate tax purposes. Mail membership dues, correspondence concerning subscriptions or changes of address, and postmaster notices or undeliverable copies to Association headquarters in Washington. When changing address, please allow six weeks' advance notice and include old address (send address label from latest issue) along with new address. Advertising rates and circulation data are available on request from the Advertising Manager in Washington.

PROGRESS COMES TO Black Mesa

ROBERT ASHTON JR.

From the desert floor of northeastern Arizona a massive highland rises 3,300 miles square and 8,000 feet above sea level. The plateau is sacred Indian land. Although life there seems the same as it has been for centuries, a profound transformation is coming to Black Mesa and other remote parts of the Southwest.

For centuries Black Mesa has been home to the Hopi Indians, who live in villages on its southern end. The mesa is an island in the middle of the Navaho reservation, and part of the highland is shared by the Navaho and the Hopi.

Los Angeles and Las Vegas are a long way from Black Mesa but apparently not far enough. Already tremors from these cities can be felt on the mesa. In 1970 Peabody Coal Company opened a giant strip mine just south of Black Mesa's north rim to supply coal to the new Mohave electric power plant in southern Nevada, which in turn generates electricity for distant urban patrons.

Black Mesa is only a small part of a long-term plan to extract coal for a network of power plants near the Four Corners of the Southwest, where the borders of Utah, Colorado, New Mexico, and Arizona touch. A consortium of 23 utilities from seven western states, calling themselves WEST (for Western Energy Supply and Transmission Association), already operates one huge power plant in addition to Mohave and has plans to build four more. Most of the electricity will be used by southern Californians. WEST has stated that by 1985 the power plants in the Four Corners area will produce "more than 3 times as much power as Tennessee Valley Authority [and] 17 times as much as the Bratsk power project, largest in the Soviet Union."

By-products of all this power production—lethal, blackened air and desiccated, ravaged land—eventually may ruin the entire area and the Indians who live there.

According to Peabody Coal Company large-scale coal mining on Black Mesa "means increased activity and change" for a land that traditionally has supported livestock grazing and subsistence farming. Peabody stated that the arrival of big mining operations would "bring a new era to Black Mesa." The company is dead right.

For the Navaho and Hopi Indians stepped-up industry may provide a new chance to share the benefits of the standard American way of living. The Indians need money for new schools, roads, and hospitals. But the future will tell whether this opportunity for Indians to become like white Americans will help or harm them. A style of living that is respectful of the earth and natural things may well be lost. The power blueprints could mean disaster for the environment.

The Hopi, the least acculturated Indian group in the United States, will be hardest hit by strip mining and have the least to gain from it. At stake is a way of life unique in the United States. For over 700 years the Hopi have lived in harmony with nature in the Arizona desert. They are one of the few Indian groups that resisted assimilation by the Spanish. As a result they have a way of life that is essentially their own.

Basic to the Hopi lifestyle—their spiritual as well as their physical well-being—are the corn and bean crops that they raise, and these crops depend on a steady water supply. Because the average annual rainfall on the mesa is a scant 6 to 15 inches, the Hopi rely on springs and wells. Without water there is no corn; and, according to the Indians themselves, "without corn there is no Hopi."

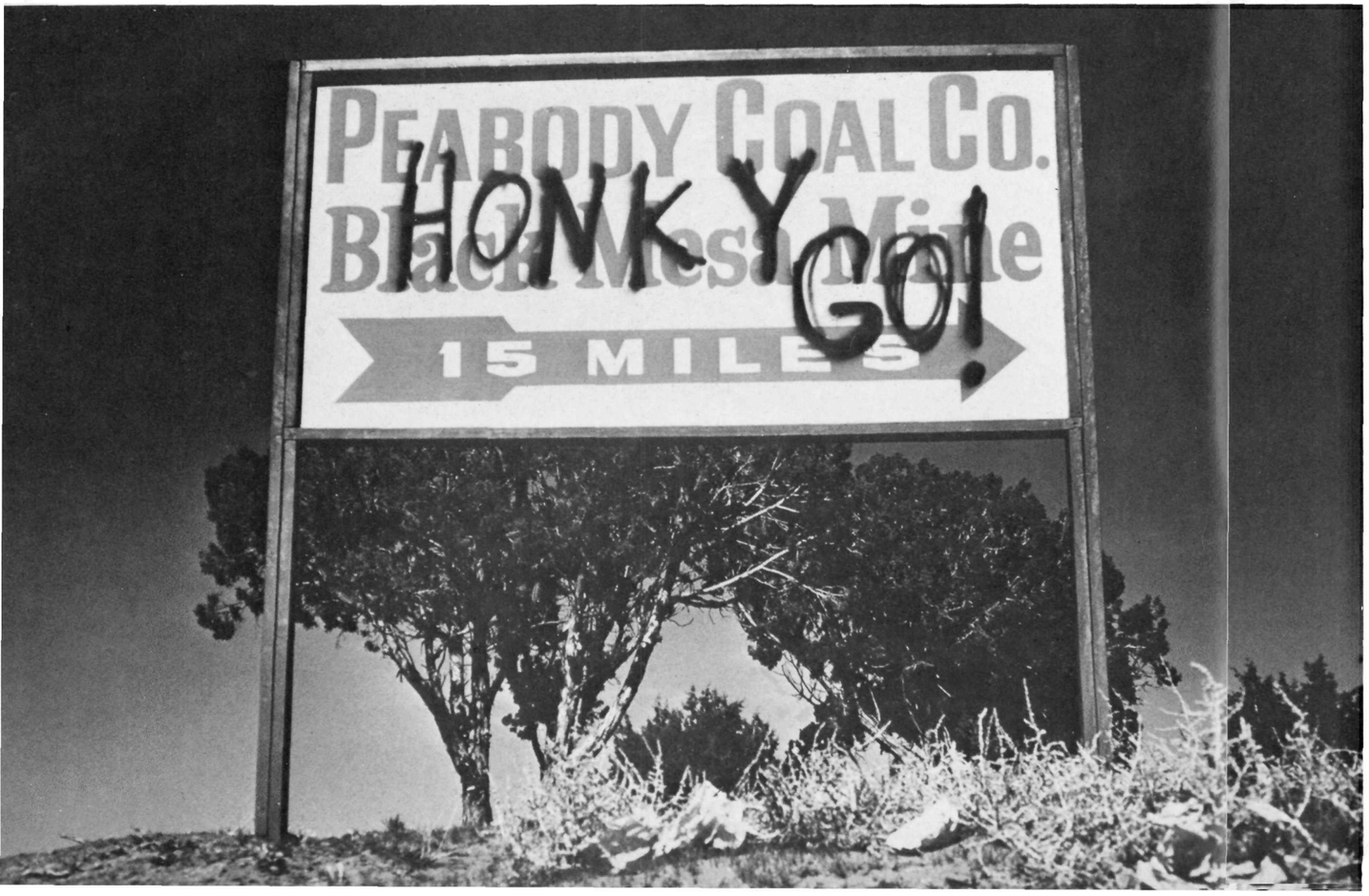
Peabody's coal operation threatens to use up some of the Hopi water. To transport coal from the mine to the Mohave plant in Bullhead City, Nevada, Peabody mixes crushed coal with equal amounts of water and ships this slurry through a 274-mile pipeline. Between 3 million and 7.5 million gallons of water are pumped each day to move 6 to 10 tons of coal per minute. The water comes from the water-bearing Entrada, Navajo, Kenuenta, and Wingate sandstone formations far beneath Black Mesa. The source of Hopi water is the Mesa Verde sandstone formation, which lies closer to the surface. According to Peabody, extracting water from the lower level will not change the water supply in the upper formation. Some geologists disagree. The water being removed is fossil water, deposited thousands of years ago during a wetter period in the Southwest. These experts believe the water cannot be replaced by nature within a foreseeable period of time.

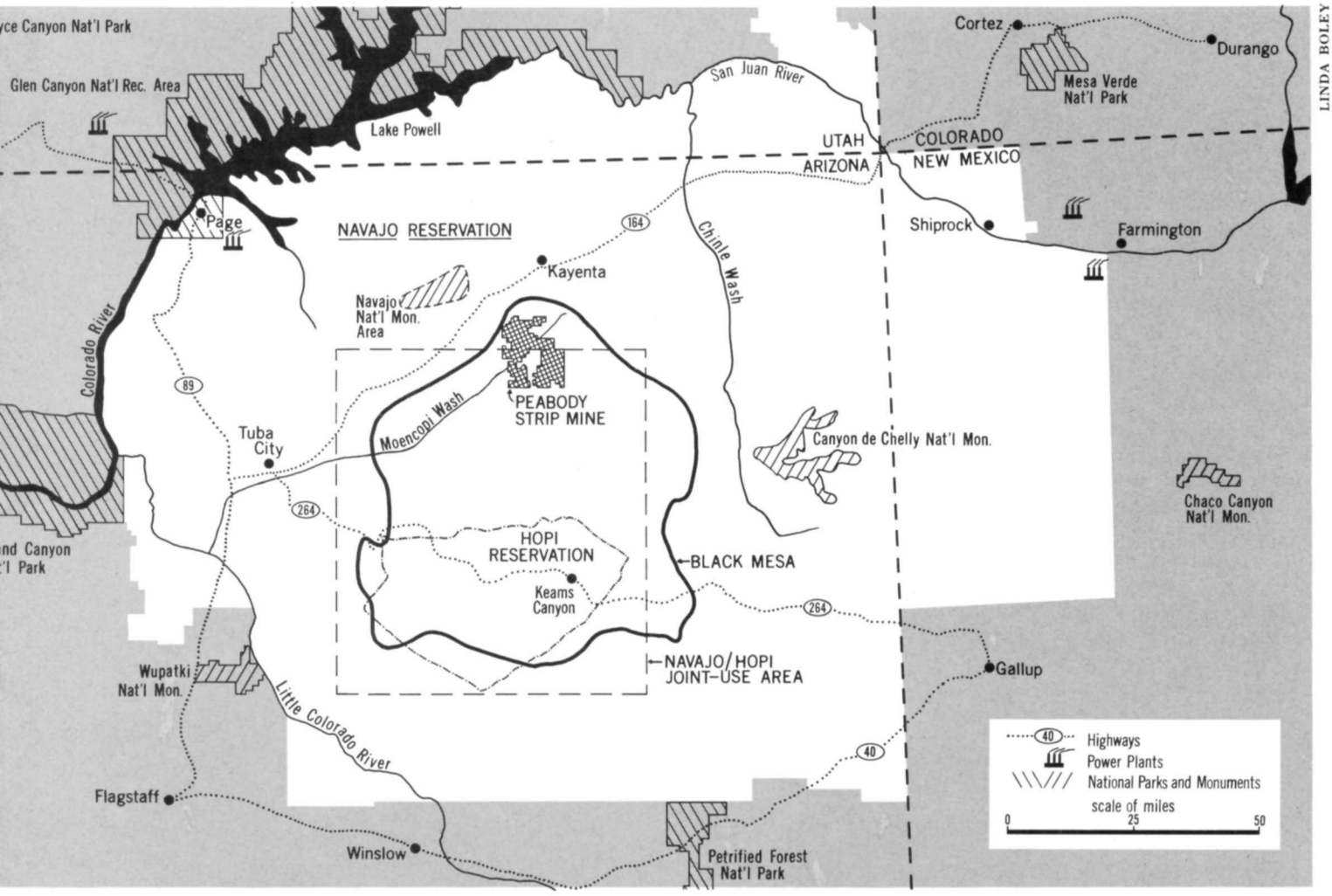
Peabody claims that impervious layers of rock will keep surface water from replacing water taken out of the deeper layers. According to the United States Geological Survey, the lower levels may not be so impervious. Some scientists believe the permeability of those formations may increase during the course of Peabody's operations. Water from the upper levels may percolate through the lower layers to replace the water withdrawn by Peabody. If this happens, the springs which water Hopi sacred corn may dry up. Because springs are the only source of irrigation, corn depends on them. If the springs run dry, the Hopi may be forced to terminate their reservation and relocate.

Desiccation of the land is not the only problem associated with strip mining on Black Mesa. Rainwater runoff poisoned by chemicals from mined areas and waste piles could be lethal to crops. Already waste from the spoil banks at the mine has been found in the Moencopi wash (a Hopi farming area) 60 miles to the south. By promoting erosion, strip mining could cause extensive damage to the already much eroded topsoil. The very uncertainty about what is going to happen to water suggests a need for caution. But instead the irrevocable transformation of Black Mesa is taking place now.

The Black Mesa strip mine will consume about 64,000

On Highway 164 sign near Keyenta, Arizona, Navaho Indians express their opinion of the mine. ROBERT ASHTON JR.





LINDA BOLEY

Peabody's stripping, marked by checkerboard patch on map, will consume 100 square miles of Black Mesa land in 32 years. The company uses giant shovels like the one opposite to remove overlying earth and extract coal. Pickup truck illustrates by comparison the enormous size of the mining machines.

acres over a 35-year period: an area almost 100 miles square. When production hits its peak, 23,000 tons of coal each day are destined to travel on a new 78-mile railroad that will link the mine with the Navaho plant in Page, Arizona, now under construction. Fifteen thousand tons per day will move through the pipeline to the Mohave plant. In return Peabody will gross about $750,000,000 over the 35-year period. The Navaho and the Hopi will receive only about 10 percent of that total.

The situation occurring on Black Mesa is nothing new: white America is repeating a very old pattern of taking Indian resources while giving little in return. The Hopi and the Navaho contracted for their small shares of the coal-mining profits in 1966 by signing 35-year leases with Peabody. Since that time increasing numbers of Indians have demonstrated concern over the strip-mining activities.

Indian business is carried out by tribal lawyers—white men approved by the Bureau of Indian Affairs of the Interior Department. Lawyers report to the tribal council, the government-created central representative body of each tribe. Historically, tribal councils are filled with "progressives," who would sacrifice customary lifestyles on the altar of economic progress. The political opposite of the "progressive" Indian is the "traditionalist."

Some Navaho traditionalists have urged an end to strip mining on Black Mesa, but Hopi traditionalists are more outspoken. They have a stronger case: the Peabody lease may have been contracted illegally.

For centuries the Hopi had no central government; each village had its own chief. The Indian Reorganization Act of 1934 required each tribe to adopt a constitution and to select a central tribal council to carry out tribal business. The Hopi constitution, recognizing Hopi preference for decentralized government, did not give the tribal council authority to lease or sell tribal lands. Implicit in the constitution is the requirement that such matters be decided only with the approval of the

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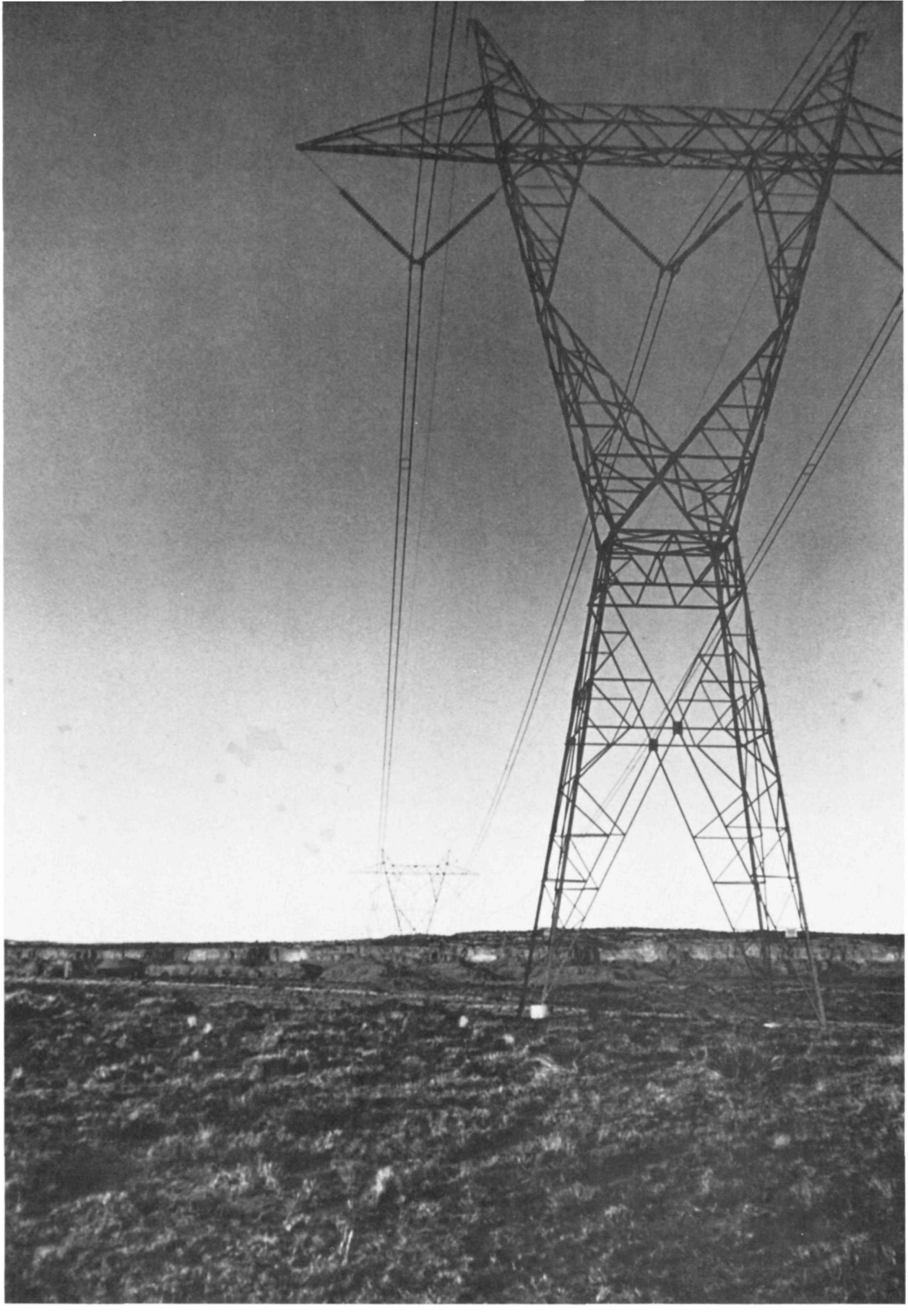
Robert Ashton Jr. worked for four summers as a seasonal ranger-archeologist at Mesa Verde National Park 150 miles from Black Mesa. He and three other seasonal rangers resigned in August 1970 after the Park Service threatened to fire them for telling park visitors about the Black Mesa travesty and its Indian victims.

TOM NOBLE



ROBERT ASHTON JR.

Power lines like these crossing the Hopi reservation mean both progress and destruction to the Indians. Many such power lines in the Four Corners area will carry electricity to watt-thirsty urban centers like Los Angeles and Las Vegas. Peabody-constructed road pictured at right leads from Highway 164 to Black Mesa mine. It is a chilling example of Peabody's engineering skills and restoration techniques.

tribe. Yet the Peabody lease was signed by the council without the full knowledge, let alone consent, of the Hopi people.

At the time the lease was approved seven of the eighteen seats on the Hopi tribal council were vacant. The towns to which they belonged never had elected delegates to the political body they did not sanction. Six of the remaining eleven seats were filled properly, but the other five delegates were not approved by their village leaders. According to the Hopi constitution a tribal council vote is not valid unless taken when ten properly certified members are present. By these standards only six of the ten yea votes for the Peabody lease were proper.

The terms of the leases promise that Peabody will return Black Mesa to the tribes "in as good condition as received, except for ordinary wear, tear, and depletion incident to mining operations." The phase may be ambiguous enough to exonerate the corporation of legal responsibility if restoration is not complete: "ordinary wear, tear, and depletion" could mean almost any attempt at restoration. The ravaging of eastern coal states serves as mute testimony to the devastating effects of strip mining. The ecological balance of the desert is so precarious that if Peabody is able to restore the environment it will have accomplished a task of divine proportions.

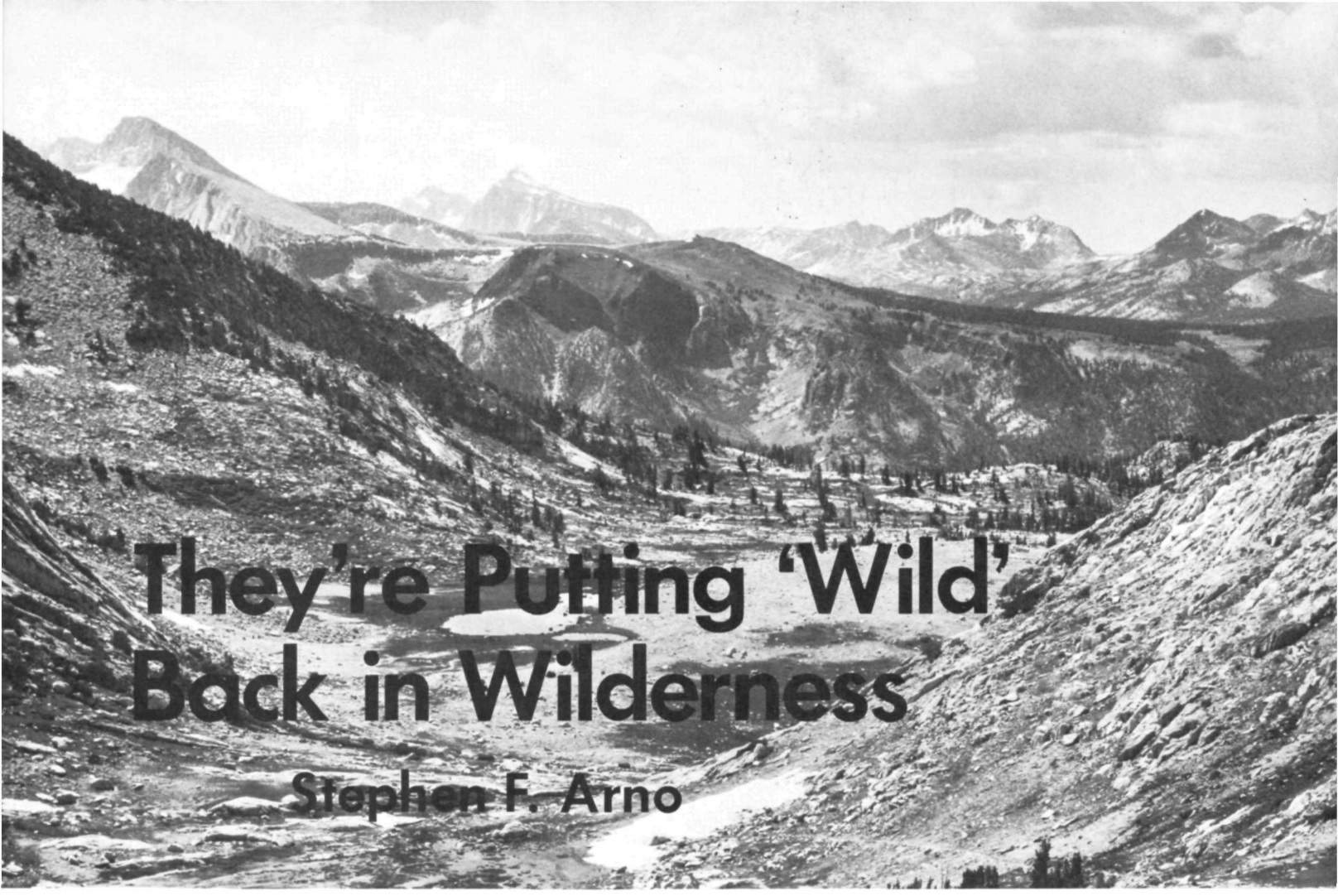
The condition of Peabody's access road from U.S. 164 onto Black Mesa may be a grim indication of the kind of reclamation that can be expected from the coal firm. A conservationist writer described the 15-mile road as "a monument to all that is ecologically and esthetically wrong." The writer, William Brown, noted that the road ignores many engineering principles. Missing culverts under sections of the road that traverse washes cause flooding, washouts, and lesser drainage problems. By following only straight lines the road presents an ugly, disruptive appearance. At places the swath cut through vegetation is 150 feet wide. Brown calls the road "a crime."

All 100-square-miles-worth of Black Mesa coal is destined to be burned in power plants near enough to spew leftover particles and gases right back onto the plateau and other parts of the Southwest desert. The danger to the environment threatened by power plant air pollution is far graver than that posed by strip mining; to discuss this problem thoroughly requires a separate article. If development continues unchecked—and the year-long Interior Department study announced in spring 1971 is a temporary and ineffective brake—the Four Corners area of the Southwest soon will rank as one of the most polluted areas in the world.

Why were the people of northeastern Arizona and the sacred land of Black Mesa chosen for this environmental sacrifice? William Brown writes: "It is the law of the industrial octopus, created by the insatiable demands of its customers, reaching into remote places and tearing them apart. It's what happens to people who speak quietly in strange tongues, to places away from highways and headlines."

Until now the Southwest has been renowned for its unique and fragile beauty. The area exemplifies the kind of asset that is an ultimate source of strength in a nation already weakened by too many and too much. We need a certain amount of electric power in order to meet with ease our daily needs. Is it worth sacrificing our natural environment just to meet them cheaply? Black Mesa is irreplaceable to the Navaho and Hopi Indians who call it home. To see their way of life and their land lost to our thirst for electric power would be tragic indeed. ■

ROBERT ASHTON JR.



They're Putting 'Wild' Back in Wilderness

Stephen F. Arno

Rugged scene in the John Muir Wilderness. U.S. FOREST SERVICE

MODERN AMERICA WAS HEWN out of a bountiful wilderness, and in return this land's rugged, untamed character shaped the American people and their way of life. The wilderness is an integral, living part of our heritage; but this important natural resource is in critically short supply. Only the most skillful management and devoted protection can save what is left of American wilderness from extinction. Recent changes in U.S. Forest Service policy, destined to return wilderness to a truly primitive state, are a step in the right direction.

About 50 years ago a few farsighted men in the U.S. Forest Service recognized that the last vestiges of primitive America were in danger of vanishing just like the thundering herds of bison and swarming clouds of passenger pigeons. Under the diligent cultivation of Aldo Leopold, an early ecologist, the seed of what became the National Wilderness Preservation System germinated in 1924 when a large part of the present Gila Wilderness in New Mexico was set aside for posterity.

Most of the present national forest wilderness was established under the pressure and guidance of Bob Marshall during the 1930s. After his untimely death in 1939 the Forest Service exhibited, with a few significant exceptions, ambivalent and sometimes antagonistic attitudes toward wilderness. Mounting public enthusiasm for wilderness finally prompted Congress to legislate the National Wilderness Act in 1964, and since then the Forest Service wilderness program has come into flower.

Inadequate management and overdevelopment of our federal primitive lands in national forests and national parks often has subjected them to abusive overuse. Public ignorance and apathy also has been responsible for the dwindling of this rugged yet fragile resource. In the past few decades millions of acres of unclassified wilderness environments have been surrendered irretrievably to "progress." But at long last the 1970s—hailed as the environmental decade—have brought a glimmer of hope for the future of America's remaining primeval lands. Now that the public is becoming aware of the value of wilderness, a new, vigorous approach to wilderness management is being instituted by the U.S. Forest Service.

Our changed attitude is indeed timely. Each year a mushrooming proportion of our nation's 205 million people debark at the roadheads in quest of a "wilderness experience." Yet only about 2 percent of the United States *including* Alaska currently is being, or is slated for consideration to be, held intact as unspoiled wilderness. Even these areas suffer agonizingly slow and uncertain action by Congress to protect them formally.

Because "wilderness" means different things to different people the Wilderness Act of 1964 provided a detailed

definition. The Act described wilderness as ". . . an area of undeveloped federal land retaining its primeval character . . . without permanent improvements or human habitation" and ". . . an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain."

Wilderness has many qualities. It provides the visitor with a personal challenge by requiring anyone who stays in wilderness to rely exclusively on his own effort for survival. The wilderness user necessarily begins to learn the art of woodsmanship. He must care for himself, carry his own burdens or care for horses under difficult conditions, make his own fire, prepare his own food, select his own camp, and set up his own shelter. Unlike the coddling civilized world wilderness is the primeval "real world" where a person makes his own decisions, his own mistakes, is rewarded for his own good judgment, and suffers by lack of it.

Outdoor excercise, fresh air, exhilarating scenery, unspoiled natural communities of plants and animals, and solitude are unsurpassed values of wilderness that will become more precious in the ever more polluted, congested, reconstituted, and used-up world of tomorrow. Wilderness serves both science and public as a majestic living museum where natural ecosystems can continue to operate in their ageless cycles of life, unmolested by "progress."

People first hearing about wilderness opportunity commonly react: "That sounds great! A real return to Nature! But why not make these wilderness areas more convenient to visit so that more people can enjoy them?" This already has happened. Much of Yellowstone, Yosemite, and the Great Smokies National Parks are sad examples of the innumerable areas of former wilderness that were "opened up" and made "a little more convenient." Wilderness by its very nature cannot be made auto-accessible or "more convenient" to visit, because then wilderness is destroyed.

William A. Worf, who is in charge of the Forest Service's Recreation and Lands Division in the Northern Rockies, put it this way:

> In nearly all of mankind there is a powerful desire for adventure, but with the many and increasing amenities the opportunities for adventure are few. Wilderness can provide this opportunity, but to do so it must remain harsh. The visitor must be challenged, and he must actually face some peril—the peril of getting lost, the peril of a dangerous mountain trail, the peril of meeting a grizzly face to face, or the peril of fording a raging, storm-swollen stream. Bertrand Russell once said "many men would cease to desire war if they had opportunities to risk their lives in alpine climbing."

Only a small percentage of the American population presently visits wilderness (roughly 2 percent in any given year), just as only a small percentage go to museums, libraries, concert halls, and golf courses. The low visitor rate is fortunate considering the very small amount of wilderness that remains as well as the fact that use of wilderness is increasing even faster than the burgeoning patronage of most other types of outdoor recreation areas.

AS ONE MIGHT SUSPECT, management to preserve the pristine, untrammeled nature of wilderness is difficult when the area is heavily used—for example, along a 40-mile stretch of trail used by 10,000 hikers and horseback riders during a short summer season. The tremendous force of such human impact already is being unleashed onto some areas of national forest wilderness and national park back country in California. As early as 1963 a management plan for the back country of Sequoia and Kings Canyon national parks in California's Sierra Nevada mountains recognized the magnitude of the threat to wilderness values. To help save this primitive environment the National Park Service drastically limited grazing by pack stock, began early enforcement of a pack-out-your-garbage policy, closed certain areas to all camping, and rerouted trails around (instead of through) fragile meadows.

This management plan stressed that trails should not be made too easy or roadlike and that basins and other small areas still trailless should remain that way lest they also attract more use and become loved to death by humanity. The plan pointed out that fish-stocking of formerly barren high-country lakes adds a synthetic element to the natural environment and creates an artificial attraction, bringing more people to the back country. The result is deterioration of wilderness serenity and trampling of scenic lakeshore vegetation and camping sites.

The plan pointed out that large bridges that make early-season high-water crossings easy for stock can increase trampling of high mountain meadows during the season they are most vulnerable. In the absence of such bridges, stock users must postpone their wilderness travels until later in the season, when the meadow soils are no longer so wet and soft and the plants are not so very succulent. Backpackers seldom damage meadows even in spring. They are accustomed to crossing streams on fallen logs; for them trail bridges and positioned foot logs are more of a convenience than a necessity on all but the largest streams.

Having recognized that lightning-caused wildfire is an important part of the Sierra Nevada natural ecosystem, the Park Service at Sequoia and Kings Canyon has been allowing some high-elevation fires to run their courses. Although wildfire played a prominent role in the western forests for centuries, in the past 50 years man largely has eliminated fire from the natural environment.

Unless fire is permitted to play its role, giant sequoias (the world's largest trees), coastal Douglas fir, ponderosa pines, and other much-admired types of natural vegetation throughout the West will give way to true firs, brush, and other plants better able to grow and reproduce under a dense forest canopy. Thick-barked sequoias, Douglas fir, and similar trees can withstand fire better than shade-tolerating species can. Periodic fires open the forest understory to permit these trees to reproduce. New growths of grass, weeds, and brush in burned-over forest areas are a food source necessary to assure a variety and abundance of wildlife.

The Forest Service's Smokey Bear advertising campaign overzealously calls all fire bad. The value of natural fires and controlled burns for big game populations, timber production, and control of tree insects and diseases is vouched for by increasing numbers of foresters and biologists.

Stephen Arno is a forest ecologist with the U.S. Forest Service. Formerly he worked as a ranger and naturalist with the National Park Service. He has contributed previously to *National Parks and Conservation Magazine.*

WHILE EMPHASIS ON BETTER wilderness management was being programmed for national parks and nearby national forests in the Sierra Nevada mountains, federal wilderness in many other areas of the West still was largely "unmanaged." Hiking and pack-horse trails once had been narrow, rocky paths yielding to skirt large trees and other obstructions and following the general lay of the surrounding terrain. In the 1960s large sums of money were spent to rebuild and "improve" some of these wilderness trails. By blasting through obstructions and making large cuts and fills, grades were held constant. All rocks and roots painstakingly were removed to make new wide-surfaced trails as smooth as gravel roads. Vegetation no longer was permitted to hang over the paths. The generous rights-of-way sometimes cleared became scars on the landscape. These over-engineered trails tempt motorcycle and trail bike riders legally and illegally to roar into the formerly serene back country, scaring wildlife and annoying peace-seeking humans.

Trail bridges were built across streams that hikers once waded or crossed on fallen logs. Even little creeks a few inches deep were spanned by flat-surfaced foot logs bordered by stout handrails. Where the route led over a high mountain pass, moderately steep and direct older trails that had lain easy on the landscape frequently were abandoned. Trail engineers often had to blast and gouge the mountainsides to construct new yard-wide paths that hold a constant grade so shallow that the traveler hardly is aware he is climbing. The new trails ascend as little as 200 feet per mile in some instances, compared with the more practical 800 or 1000 feet per mile of the old routes. As a result hikers and horsemen often have to cover 2 or even 3 times the distance, and coming downhill over such a ridiculously shallow grade is so exasperating that many hikers cut straight across switchbacks. This practice further erodes the already beleaguered mountainsides.

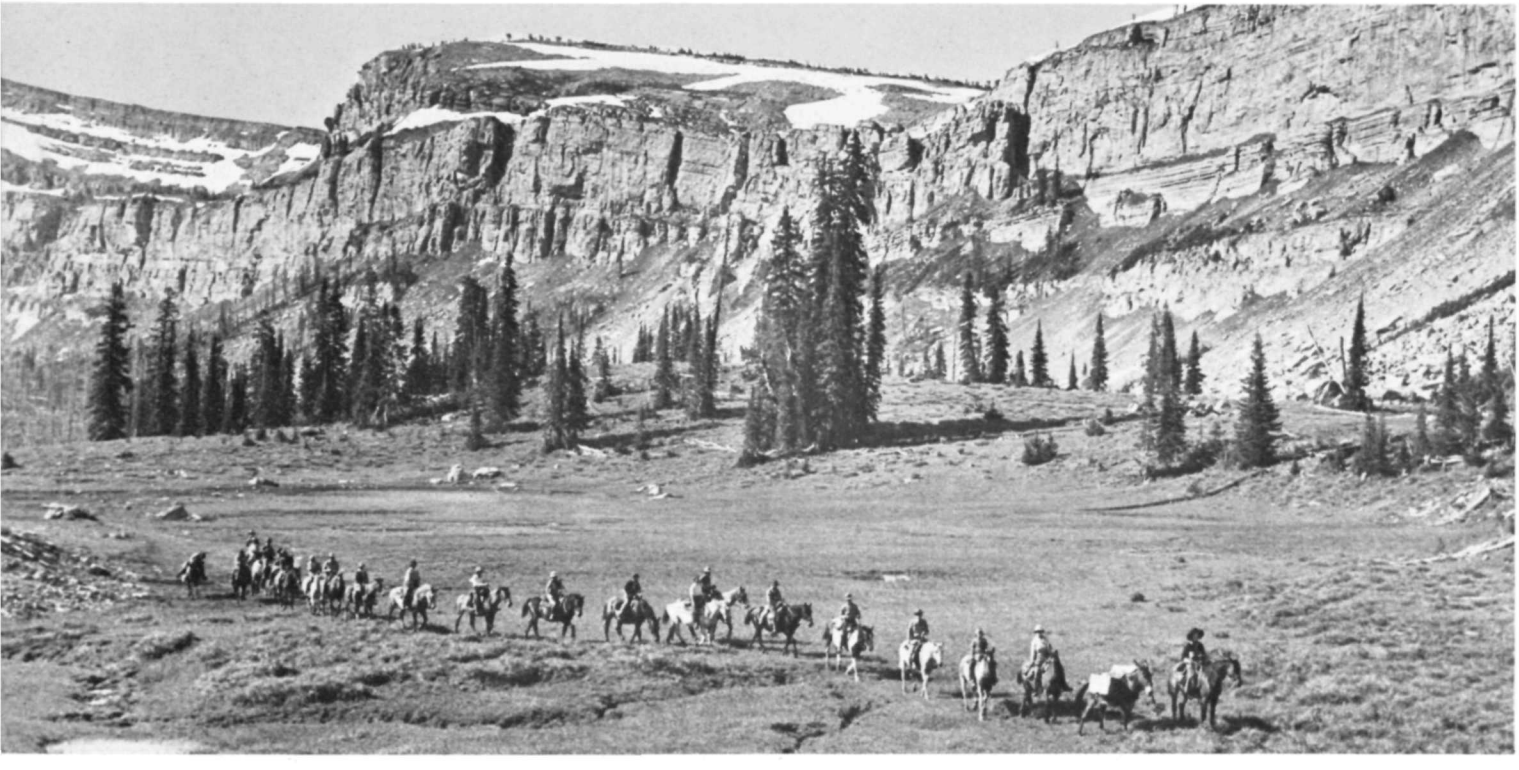
While wilderness trail systems thus have been "improved" in accord with well-meaning but inadvisable policies in some national parks and many national forests, similar practices have degraded the environment at wilderness campsites. Cement fireplaces, plank picnic tables, and even fiberglass-roofed privies were installed in some of the popular wilderness camps.

The 1964 Wilderness Act strengthened protection for certain wild areas. The Act has stimulated federal agencies to re-evaluate their wilderness management policies. Universities have been training a new breed of forester more likely to be receptive to wilderness than his predecessor, who often considered such areas a wasteful reservation of land that should be "used." Young foresters are realizing that wilderness management is a necessary and challenging field, one that finally has emerged in the Forest Service as a respectable endeavor. Indications are that although in the past the Forest Service often argued against granting wilderness classification and protection to unprotected wilderness areas, the agency now will attempt to act impartially, gathering information and setting public hearings before deciding policy.

A policy statement in the current Forest Service Manual explains:

> The term "wilderness resource" has been added to our management concept, and it is not synonymous with recreation resource. It involves management to maintain conditions of solitude, challenge, and primitive environment. Numbers of visitors will be limited to the

Trail riders pass under the Chinese Wall in Lewis and Clark National Forest's Sun River Primitive Area. Overgrazing by pack stock is a problem in some well-used wilderness areas.



U.S. FOREST SERVICE

carrying capacity of the wilderness resource. Improvements intended primarily for comfort and convenience of visitors will not be built. Trails will be kept narrow and so built as to result in minimum disturbance to cover and prevent soil erosion.

THE NEW FOREST SERVICE policies in wilderness management direct that trails be built and maintained so they appear to be a natural part of the landscape—like game trails—rather than a man-made intrusion.

Bridges will span only streams that horses cannot ford safely during the primary season of use. Facilities will be provided only where they are a necessity for the proper use of wilderness and protection of the resource, not where they will be "convenient." Elaborate trail signs with mileage distances and mileage markers no longer will decorate Forest Service trails. Trail junctions henceforth will be marked with small unpainted wooden signs listing only one primary destination or the name of a drainage and no mileage distances. More accurate maps will be provided at ranger stations and roadheads to encourage wilderness users to develop their map-reading skills.

Tables and fire grills will be removed from wilderness areas. Horse corrals, pasture fences, and permanent shelters, as well as "back-country slum" camps maintained by some outfitters, also will be phased out. In the Northern Rockies pack and saddle parties soon will be limited to a maximum 50 head of horses, and present overgrazing of high-country meadows by stock will be halted.

In the future it may be more difficult to arrange huge luxury parties in which each guest has two pack horses and is served in screened comfort on a cloth-covered dining

STEPHEN F. ARNO

Under new Forest Service policy, improvised bridges like the one crossing a surging stream in Kings Canyon National Park, above, will be chosen over man-made constructions wherever possible. Most wilderness structures like the cabin in Bob Marshall Wilderness pictured below will be phased out. Trail crews will use hand tools rather than machines, as workers on a John Muir Wilderness trail are doing below left.

U.S. FOREST SERVICE

table meals cooked on a kitchen-sized propane range. Clients who are transported and fully catered on "wilderness trips" —sometimes even having their fishhooks baited by guides and meals served in their bunks—are insulated totally from the meaning of wilderness. It may no longer be feasible for packers to provide these clients with amenities like ice for mixed drinks, ice cream cooled with dry ice, kegs of beer, and frozen fish for poor fishing days. The Forest Service hopes to establish "back-country" or "frontier" areas —differing from the wilderness classification—where management would not need to protect a wilderness environment. There as in other roadless areas outside classified wilderness regulations can be more flexible.

The new wilderness policy requires everyone, including Forest Service personnel, to pack out his own unburnable litter. Existing garbage pits may be used only so long as they remain efficient and sanitary and then will be covered over. Hopefully this guideline will be changed in favor of eliminating all garbage pits now.

The most dramatic illustration of the Service's deep commitment to the welfare of wilderness is that the agency has restricted and inconvenienced itself. Except in emergency situations it has reverted to maintaining trails with hand tools like crosscut saws, pick, and shovel, instead of portable machinery. The Service will phase out most of its administrative structures (such as cabins, lookouts, barns, storage sheds, and fences) in wilderness. Although there has been some talk in the Forest Service of using helicopters to pick up garbage and contact visitors in the rugged Enchantment Lakes Wilderness proposed in Washington, the agency probably will realize that if hikers can reach the Enchantments on their own two feet or leading a burro so can foresters! By the same token the Forest Service should not repeat the mistake it made in 1970 by making daily checks with aircraft to see that everything was going smoothly among a large party of Boy Scouts in Montana's Anaconda-Pintlar Wilderness. To youngsters in this group that surveillance must have been as annoying as a doting mother constantly butting in on their fun and freedom. The practice largely nullifies a "wilderness experience."

Ironically the National Park Service—which has in some of its large parks been the leader in wilderness management—lacks a strong, comprehensive, servicewide program for wilderness protection. Instead of active management to protect wilderness resources from overuse and other threats, in many places the Service has adopted a custodial approach. Park superintendents (who often have had little background in ecology or even biology) or individuals on their staffs often have been responsible for making key decisions on how to manage the park back country.

At most wilderness trailheads the Forest Service has set up registration boxes for visitors. In this way the management agency hopes to obtain reliable data on the number of people, size of groups, mode of travel, and interests of users on all trails in these areas. In the Northern Rockies registrants get a small card explaining good wilderness manners, including how to handle a major but seldom mentioned problem: proper disposal of human wastes. It suggests that people dig shallow individual holes and cover them over. This practice allows for quick decomposition by soil bacteria, virtually impossible in the large and deep privy vaults. Crude privies may continue to be an antipollution necessity in heavily used areas, however.

Many western wildernesses are relatively large, and most are congested only along especially popular trails. Visitors seeking solitude can find it on less-traveled trails and by setting off cross-country. However, the Forest Service is aware that even the most careful supervision to disperse visitors on a large network of trails, control of facilities, and strict enforcement of regulations cannot preserve the wilderness ecosystem and insure users a true "wilderness experience" in the face of extremely heavy use. A tragic example is the tiny (34,718-acre) San Gorgonio Wilderness at the doorstep of 10 million megalopolis dwellers in southern California. With 62,000 visitors in 1969, trampling, stream pollution, noise, vandalism, and congestion were so rampant that the agency is planning to establish a permit system on a first-come, first-served basis. Ultimately the privilege of using wilderness probably will have to be rationed in our overpeopled nation, much as the privilege of shooting bighorn sheep, mountain goat, or "using" other scarce natural commodities has been rationed to prevent their extinction.

The only alternative to rationing the privilege of entering wilderness is to increase vastly the extent of our presently wild areas to be formally protected as wilderness. At the same time the world population would have to be stabilized or, more likely, reduced. Wilderness provides a valuable relief from the high pressures of our hectic society. Just knowing that a piece of untrammeled America, a frontier, still lives somewhere probably provides emotional support for countless Americans. Some say that the opportunity for mankind to experience wilderness is essential to maintaining cultural sanity. Judging from the standard of cultural sanity in the United States, we can ill afford to lose any more of our native wilderness. ■

U.S. FOREST SERVICE

Falls on Beetlebug Creek near the head of Long Canyon in the John Muir Wilderness.

PLANET EARTH
UNDER THE OCCUPATION

Durward L. Allen

No one suspected, even five years ago, that 1970 would go down in history as the year of the environment. Today there is little doubt that this was so. We have witnessed a sudden awakening in a field that long commanded little public attention. There is a spreading conviction that man has vital relationships to the earth and that we are badly overdue in essential upkeep of the property that supports us.

Man's obligation to succor these relationships was pointed out often in the past by people commonly ignored as impractical skeptics and purveyors of gloom. But talk about resource destruction and the need for conservation never seriously impeded the working philosophy of Americans. They nurtured a vigorous optimism that science and a plentiful endowment of natural wealth could continue indefinitely to provide more and more of the mass-produced equipment for comfortable living. If there were constantly more people to be supplied, that provided bigger markets, more capital, more research and development, and endless new marvels of technological achievement. All this had to be so because it was the way economists said a modern society should operate.

It should have given us pause that much of the world did not participate in this plan for progress. But there was a rationale to quiet anyone's misgivings. Experts of appropriate kinds were sure that by erasing the backward cultures of other lands and substituting our superior knowhow, the "underdeveloped" countries could be industrialized in our image and thus partake in the good life. Twenty-five years ago William Vogt and others said this concept could not work for two reasons: the impossible demands of geometric population growth and limitations of the resource base. Vogt's book *Road to Survival* was a best seller, but its ideas did not influence national policy-making.

A lot of people understandably retained their all-is-well feeling about human affairs. The magnificent accomplishments of science were there for all to see. If we knew so much, how could we go very far wrong? On this continent people early developed an abiding suspicion that natural scenes indicated unused assets. Unused meant going to waste. The utilitarian view was traditional and automatically right. It was the basic criterion in appraising any undrained marsh, any unplowed prairie, any uncut woodland, any undammed river, any unwatered desert. This kind of outlook has literally remade the face of our land. In an expanding population there are entrepreneurs for every conceivable project, and rapidly developing technology makes almost any remodeling of the scenery physically possible.

This outlook can no longer be sustained. We must develop a resource strategy, and we must make modern society responsive to human life and the living complex on which human life depends. Never in the world's history has such a revolution in human thought and habit been necessary. If the essential decisions were totally at the will of persons over 40 years of age, I suspect that any solution would be impossible. But restive young people have found a genuine cause; they have identified their real complaint against the establishment. They are likely to demand, and possibly to get, a better world.

In a state of nature, those living things survive that are part of an orderly and durable ecosystem. The ecosystem includes a community of plants and animals organized to perpetuate itself. It extracts nutrients from the earth and atmosphere, ties up sun energy in chemical reactions, and uses the energy to operate its life processes. It breaks down and recycles wastes, and it refreshes its environment. It is unlikely that any form of life can survive outside a community in which it has some constructive function. "Constructive" might mean predatory on other organisms; the built-in controls on every living thing must be effective, or the community will be quickly overrun and destroyed. In the natural world "too successful" is the same as "unsuccessful."

It is self-evident that for millions of years the creatures ancestral to man survived in their ecosystems and served their

purposes in the long-established order. Their adjustments and status might well be a place to start in appraising what has happened in recent times. It is reasonable to suppose that some 4 million years ago our immediate progenitors were living in fruitful tropical habitats of Africa and possibly Asia, probably forest-edge or savannah country that had undergone relatively little change over recent geological time. Its plant and animal life was finely adjusted, flexibly geared to the vicissitudes of climate, and buffered with compensations against the abundance or scarcity of individual species.

The ancestral human creatures were endowed favorably by a remote tree-living ancestry. They had binocular vision, a generalized set of teeth, a mobile wrist, and a five-fingered dexterity suited to the varied demands of personal grooming, digging roots, gathering berries, and plucking little birds from nests. Most significantly, they were developing a mental capacity for elaborate communications. Like other animals, they had an inborn pattern of social behavior, but they improved on it; through the long childhood characteristic of the species, parents imparted to their offspring the accumulated results of their experience. This was an unprecedented level of learning.

We can make some significant deductions on the probable ecological position of this hominid ancestor, as certain relationships are practically universal. Of prime importance, the prehuman had a self-renewing food resource. He also had the advantage of automatic population control; the birth rate and death rate were so balanced as to keep his numbers at a density that was socially and economically tolerable. For the kind of life he led, that density must not have been high, which probably rules out any important environmental pollution—the waste disposal system also was automatic and effective.

This way of life was a biological design for survival—not of the individual, but of the species. For every kind of life through the ages, there has been a mass sacrifice of victims to the culling of evolution. Only by such means has improvement been possible.

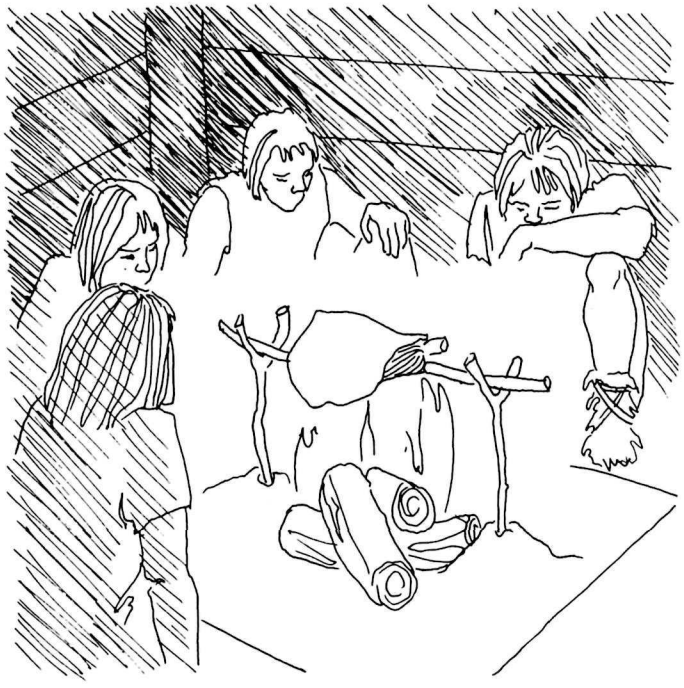
Obviously a great leap forward came when this erect, ground-dwelling primate began to make tools and use fire. On that basis he became a man, and something new had appeared in the universe: culture. Information then was being passed on from generation to generation, and better ways of doing things brought increasing control over the environment. This process increased survival, and birth rates must have shown erratic gains over death rates. Population built up as the enlightened human found it possble to survive in habitats that formerly were marginal.

Cultural progress among primitive peoples was slow, and no doubt there were numerous setbacks. But our point of present interest is that over many millenia the human animal was able to leave the security of its biological niche in the ancestral ecosystem. Men moved out of the tropics and penetrated far into the rigorous climates to north and south.

Many life communities had enough resilience and overproduction to provide for small numbers of men who hunted and gathered for a living, so in the beginning the increased numbers of humans must have wrought little change. The first major human influence on the earth probably was through the burning of vegetation. Other extensive changes began about 10,000 years ago with the advent of a new kind of culture. Wild grasses were cultivated, and dogs and other animals were domesticated. People were concentrating in settlements larger than anything previously seen. By this time, the human race may have numbered around 5 million people. As agriculture spread, especially through the use of grazing animals, the increase of mankind was marked by new extensive changes in grasslands and forests. It is fair to suspect that the story of the earth's deserts is far from told.

As one way of looking at it, we might say men took about 2 million years to learn to grow crops and to build a population of 5 million. From that point on, which means in the past 10,000 years, human technology has developed from digging sticks to moon rockets, and the population has become 3.7 *billion.*

ALL DRAWINGS BY NANCY MORAN



The ecological position of humankind has been vastly altered. The old mechanisms for life support and numbers regulation no longer function. In a real sense, man has lost his place in nature, and he has lost the kind of racial security that his place provided. He is now using, if not occupying, every major habitat on earth. He is abroad upon the land totally responsible for managing his food supply, his birth and death rates, and his living standard. Most critically, he is responsible for his own future, if there is to be one.

These are the challenges we face today. Our use of the earth is without plan and without provision for renewal. On every side the march of events is accelerating, which implies a point of crisis ahead. People all over the earth are beset by their own immediate problems, and often the great issues are obscured. It is essential that we know what those issues are, what moves are urgent, and what price must be paid for any welfare programs we can devise.

Despite all our vaunted science, we are not well prepared technically for decision-making, or even for problem analysis, in the field we call human ecology. Yet any objective person can see indicators that we are on our way somewhere in an undignified hurry. The most obvious of these signs is the trend in human numbers. It has long been known that populations do not add; they multiply. Given space and resources, they increase by compound interest.

As testimony to this, the human population of the world reached its first billion about 1850, the second billion by 1930, and the third in 1961. The fourth billion is due in 1975, and a common prognosis for the year 2000 is 7 billion. At that point the doubling time is likely to be about 23 years.

Obviously, this is geometric increase, but it falls short of describing our trouble in true proportion, for certain social and environmental conditions are changing even more rapidly than the population. There are convincing indications of this, although remarkably few studies have been made in some highly critical fields. For example, too little is known about the effects of high population density on human beings. Yet it is clear that concentrations of people commonly produce high rates of abnormal social and psychological behavior. We take for granted an increased disease potential in high densities. It is less well known that, as numbers grow, there is a rapidly accelerating increase in competition and the complexity of relationships among individuals.

Most of us have observed that people in sparse populations do many things for themselves. They have wells, gardens, and waste disposal; and commonly they meet their own emergencies. Their self-dependence holds the tax rate down.

In contrast, the inhabitants of crowded cities are dependent on public service for nearly everything they require. Food, fuel, power, water, waste disposal, a high standard of fire and police protection, public transportation—these are provided on a community basis. Any disruption causes major hardship. All such services must be paid for, and taxes must be high.

We may well be seeing repeated demonstrations that when people are mass-produced they are more, rather than less, expensive. With the build-up of social stress and complexity in concentrations of population, the possibility diminishes of collecting enough taxes to mitigate the problems and keep living standards high. In recent years it has been common to hear on the evening news another mayor quoted as saying that local resources cannot meet the needs of his social programs and that he must turn for revenue-sharing to the federal government. There, of course, we do not collect enough taxes either, so the bill is placed in the national debt. Charging things to the future and then degrading the currency is a kind of graft considered respectable because everyone is in on the deal.

In terms of problems and solutions, we seem to be painting ourselves into a corner. Population growth creates new difficulties faster than anyone can find solutions to the old ones.

Another aspect of the environmental problem concerns our mechanized industrial might, and here again we are surrounded by skyrocketing curves of increase. The production of electric power is doubling every decade, and with it air and

water pollution caused by waste materials and heat. In North America automobiles are increasing twice as fast as people; the consequent contribution to atmospheric pollution needs no comment. Solid-waste production has doubled in less than 10 years and now has reached an average of 5 pounds per person per day.

We talk about pollution control, but have we looked carefully at the fiscal proportions of this job? The Organization for Economic Cooperation and Development has calculated that it would require 2 percent of the gross national product of industrialized nations to slow down the rate of pollution. About 4 percent would stabilize the situation. For the kind of cleanup people visualize it would be necessary to expend 16 percent, or about $150 billion per year in the United States.

No one needs to prove that more people use more space and more resources, but the impact of modern science on the earth's fund of natural wealth needs to be better understood. According to many indices, our technology is doubling about every 15 years. In the hands of a rapidly growing population, it creates an ever-increasing demand on resources. However, the effects are far from uniform.

About 1 billion people live in the industrialized western nations. They have access to half the world's available arable land and are using much more than half the earth's yield of material products. About 2.5 billion people live in the largely agrarian, underdeveloped nations; and more than half of them are undernourished and otherwise underprivileged.

It has been estimated that a child born in the United States requires in its lifetime at least 25 times the resources that will be used by a child born in India. This is accounted for by a difference in living standard. It illustrates dramatically the rate at which natural assets are used up by an industrialized society. At such a rate, and if anything near the present population level is maintained, a great deal of the world is not likely to be industrialized.

Our outlook for the have-not nations should keep in sight the basic facts of population increase: This year the gain in world population will be 72 million. Next year it will be more and the year after that still higher. If today about half the world is underfed, underclothed, and undersheltered, what chance is there of catching up? And if we find it difficult to feed people, what can be done to provide the more costly amenities of our culture, such as education and medical care? Even in this country, despite public and private investments that often seem too great to bear, we are falling far short of adequate service to the population. We have tried diligently to mass-produce some of these refinements. But in the words of a philosopher I once knew, there are still some things that take 9 months. There are qualities in human beings that cannot be mass produced. If men are to rise as individuals to their highest stature, they will have to be custom jobs.

In the environment issue we are dealing with two variables—population and living standard—and one constant—the finite earth. Obviously, too many people are degrading their way of life by competition for too little of what they need. In the process they are digging into the capital stock of resources that should serve mankind well into the future. Some of these assets can be renewed and made productive through knowing management. Others are gone forever.

Consider what is happening to some of our great, non-renewable natural resources, the fossil fuels—coal, oil, and natural gas. If we keep on as we are, our history will record that in a little over 2 centuries a few generations of men recovered and burned, for a minor portion of the available energy, stores of carbon that took a hundred million years to deposit in the earth's crust—despite the fact that these versatile minerals could have served mankind for thousands of years as industrial raw materials.

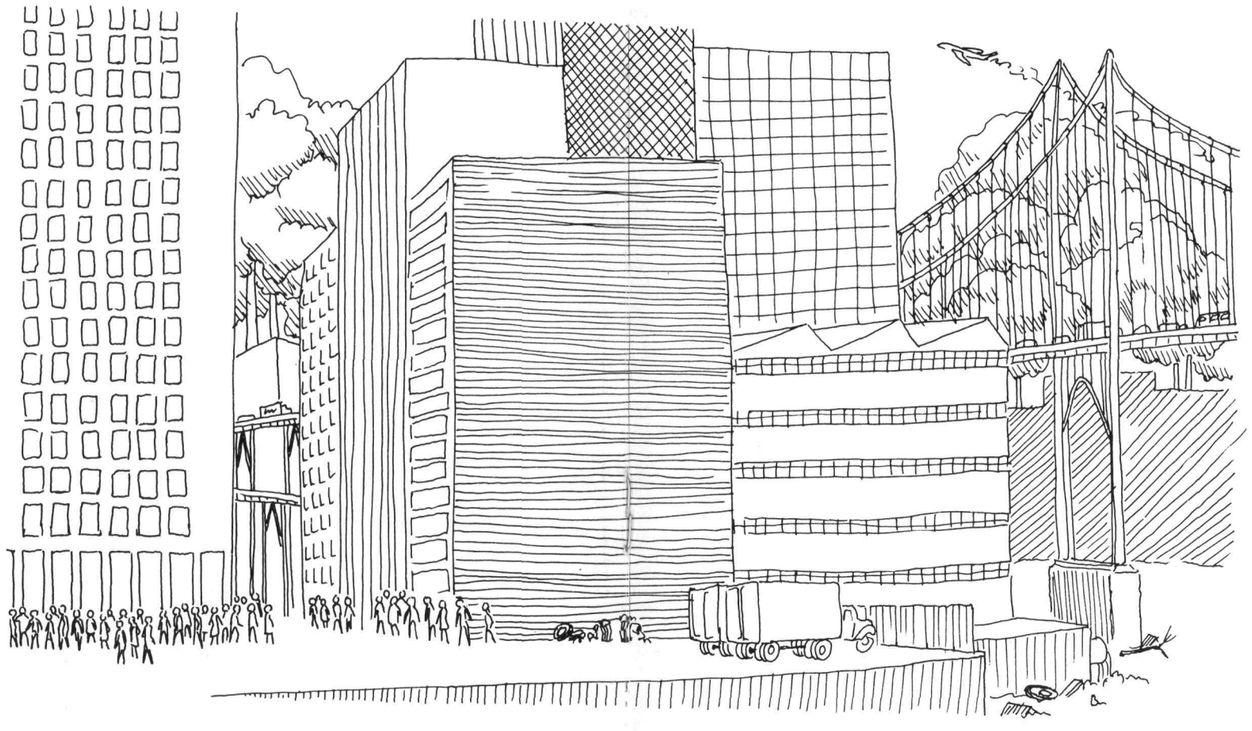
This particular resource-use program has another angle, because in liberating all that carbon dioxide we are altering the long-standing composition of the atmosphere and changing the earth's climate. Estimates of how this might turn out are so widely divergent that it is evident we do not know where we are going.

In an era when we should have learned better, it seems that we inevitably will lose more of our renewable resources. The oceans of the world are open to all peoples, and the commercial interests of many nations, armed with the most modern and sophisticated gear, are finishing off our remaining whales and competing for what they can get of fish stocks and other sea foods. One wonders how long such resources can last in the face of growing protein hunger around the world.

The most characteristic feature of human demand today, and as far as can be estimated in times ahead, is that it has no limits. We hear it said frequently that "we are going to have the people; we must get ready for them." On that basis you can justify the destruction of anything. In effect, economic need is a poor reason for exploiting any resource in today's world. If we uncritically pursue the expanding economy idea, we will use everything for immediate gain; and nature will stop the program when the supplies run out. It would seem to be greater wisdom to put on the brakes by design and preserve some options for the future.

It seems evident that, if we have any long-term intentions to occupy this planet, we will have to convert it into something resembling that self-regulated primordial ecosystem. This would imply a relatively stable population at a level that could support high living standards for everyone. Resources would be used no faster than they could be replaced or substituted for. Organic wastes would be used to improve the land, and other wastes would be recycled as raw materials.

In comparison to what we actually are doing today, this steady-state concept seems visionary and beyond attainment. But it has one thing going for it: it is the only alternative to disaster.



By all odds, the human swarming is our greatest problem. While it goes on we have little chance of improving the lot of our kind. Considering the large amount of information on this subject carried by the public press in recent years, it seems that most people should know the basic facts.

Yet our business interests and to a great extent our government are following policies based on the antiquated idea that more people mean a higher level of living. Over this country mayors, governors, and chambers of commerce are describing with great pride their plans for growth and development—expansion of industry, more land on the tax rolls, land reclamation, new communities. It still is taken as holy writ that the gross national product must increase forever.

As a nation we should be committed urgently to a population policy. In addition, we need a realistic program of quality control for the environment. Obviously we must change the long-established principle that commercial interests may write off environmental pollution as a profit. We should insist on halting the great and costly land and water developments that deface our natural features and fill in the blank places on our map with new populations.

No one should expect that people as individuals can accomplish these things. They must act in concert through their government. The key to doing this is for citizens to identify in government the individuals who understand the big issues and who have the courage to make changes. Those individuals should have active support of the kind they most certainly will need.

The critical cause of population control is potentially a unifying issue for all mankind. It belongs to rich nations and poor nations, rich people and poor people. It is the most universal need of modern society.

There has been much talk about zero population growth, and that is a good immediate goal. But it is not enough. There are many reasons to doubt that this world can support more than 1 billion people at respectable living standards. This might mean 100 million in the United States, or half the present population.

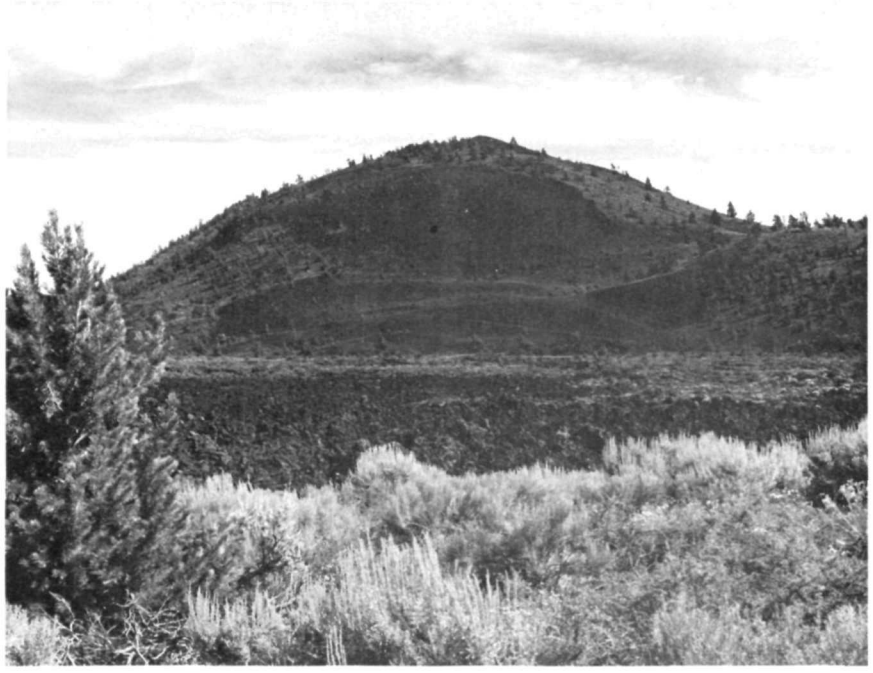
Any such estimates are speculative and need not be defended. A downward trend is what counts—a decline that could be monitored carefully and stabilized at a comfortable level. Of course, such a reduction could be brought about only through a socially satisfactory and technically effective birth-control program. The large families of past generations must be counterbalanced by small families in generations to come. That could mean one or two children for some; none at all for others.

It is true that the demands man must make upon himself involve a certain loss of freedom. But greater demands have been made for the survival of nations and for lesser causes. It is a small price to pay if it will avoid the debacle that faces the earth and its inhabitants if the generations now alive fail to understand and cooperate in this time of universal need.

In taking over this entire planet, the human species found many ways to bring chaos out of order. We abrogated the natural controls. Now is the time to establish our own. But the truth is that in making new rules, we will probably find that we are really going back to the old ones. ■

Dr. Durward Allen is professor of wildlife ecology in the Department of Forestry and Conservation at Purdue University. This article is adapted from a paper presented at the forty-eighth annual convention of the Izaak Walton League of America.


Moonscape On Earth



Big Cinder Butte—the largest cone at Craters of the Moon

A century ago Washington Irving described the grim barren lands of south-central Idaho as a "desolate and awful waste, where no grass grows nor water runs, and where nothing is to be seen but lava." In recent years its jagged volcanic features, startling in their similarity to the surface of the moon, have been used as practice targets in moon-landing experiments. That same similarity gave the area its name and protection in a national monument. Craters of the Moon National Monument, 83 square miles in area, attracts thousands of visitors each year. The monument, established in 1924 between the towns of Arco and Carey, encompasses the most recent part of a lava field that extends for hundreds of square miles. More than one awed visitor after viewing the strange terrain has expressed his amazement with the exclamation, "It's like the end of the world!"

Early observers of the country that is now the monument, deceived by the fresh, barren look of the lava, believed it to be only 100 to 150 years old. It is now estimated that the last eruptions occurred approximately 2,000 years ago. The look of newness is due to the fact that the accumulation of soil in such an arid climate is a slow and difficult process. Core samples taken from the limber pine trees that grow in the monument have provided a more accurate estimate of the true age of the lava field.

Thirty-five cones and vents and 30 different lava flows resulted from the several epochs of eruption that occurred. The source of the lava was a massive fissure, now known as the Great Rift, that first opened many thousands of years ago. This first upsurge of molten lava, issuing at a temperature of about 2,000° F, carried with it to the surface huge chunks of granite that may be seen in the monument today. A chain of cinder cones was formed by the accompanying eruption. Most of the features resulting from the following volcanic activity were buried by later flows, but there are remnants to be seen in the Devils Orchard and the craggy area south of Big Cinder Butte.

After a rest of many centuries, the Great Rift reopened and poured forth more lava, forming a zone of weakness in the earth's crust and becoming an active earthquake center. The chain of large cinder cones that stretches southeastward through the center of the monument was formed at this time and appears today as islands above the subsequent flows of lava.

The most recent period of eruption followed closely, and to it belong the monument's barren, black lavas. North Crater, one of the more prominent features, reopened and discharged a river of billowy lava that is crossed by the road leading into the monument. Big Craters poured out four flows that moved in different directions throughout the area. The line of spatter cones along Crystal Fissure was formed, and lava moved eastward and westward from them. A chain of pit craters was formed as areas along the rift collapsed.

When chemical composition is considered, only one of the earth's many types of lava—basalt—is found in the Craters of the Moon. Measured by physical characteristics, however, the monument has two very different kinds of lava—pahoehoe (pah-hoay-hoay) and aa (ah′ah), the names being Hawaiian words that have been adopted as scientific terms.

Pahoehoe is a unique, wrinkled rock with glassy, glowing crusts. It covers about half the area of the monument and is filled with caverns, which are found only in the pahoehoe flows. In places it resembles toothpaste that has been squeezed from a tube; in other places it looks like froth or like rope. It was formed by the crusting over of the flow while the molten lava underneath still was moving forward. Because of the gradual slope of the land, only the upper ends of the resulting lava tubes drained out when the eruption stopped. Natural bridges exist where portions of the tubes' roofs collapsed.

Marylyn Cork

In many places the tubes are still intact and form the characteristic pahoehoe caverns.

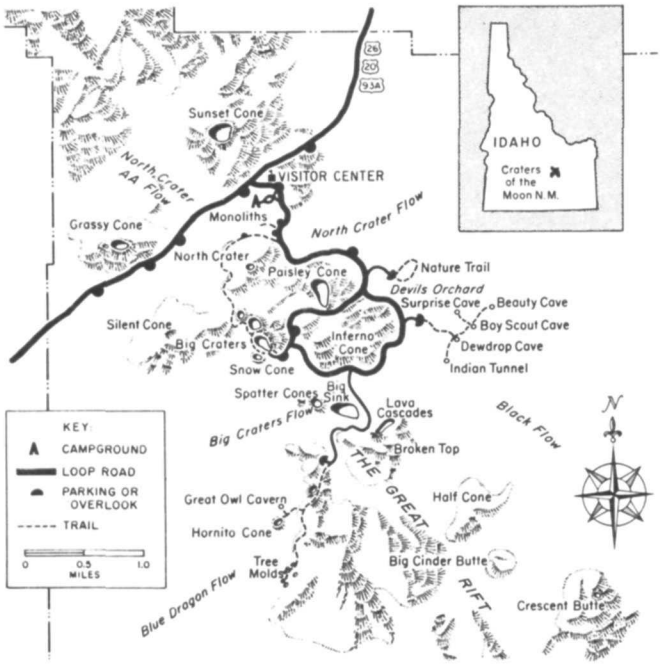
Stalactites formed by molten lava dripping from the ceilings of the tubes are found in some of the caves. Lava has hardened in trickles on the walls and has left shallow ledges parallel to the floors that show the varying levels of the receding lava. Sometimes the last rivulet of lava hardened while still in a cave and is plainly visible.

Aa lava bears little resemblance to pahoehoe. It is rough and jagged and arduous to walk across. The spiny flows of aa have been described best as resembling a river of slush ice as it breaks up in the spring. Imposing flows are to be found in the monument, some of them as thick as 100 feet and spread out over the plains for miles. A series of aa flows have occurred at the edge of the North Crater Flow, one of the monument's youngest, and tumbled heaps of aa lie on both sides of the highway.

Three types of cones are found in the Craters of the Moon. The most familiar to visitors are the cinder cones, which were formed by fire fountains at the time of the eruptions. They have black, loose, cindery surfaces and smooth, conical profiles that were elongated toward the northeast by the winds that blew during the eruptions. Big Cinder Butte, rising 800 feet above the lava plain, is the largest cinder cone in the monument; others include Grassy Cone, North Crater Butte, and Silent Cone, all of which are about 450 feet high. Most of the cones were formed by a series of eruptions, but Grassy Cone is believed to be the result of a single, great eruption.

Spatter cones, also, were formed by fire fountains, but by smaller ones than those that built the cinder cones. Clots of lava propelled by these small fire fountains lacked the expanding gas to form cinders and moved so slowly and through such short distances that they clung together viscuously upon contact with the ground instead of landing as cold cinders. The steep-sided spatter cones lack the height and breadth of their big brothers, the cinder cones. They are less than 50 feet high and 100 feet wide. A perfect chain of spatter cones marches across the landscape near the end of the access road.

NORTHWEST PART OF CRATERS OF THE MOON NATIONAL MONUMENT



FEDERAL GRAPHICS

The third type of cone found in the monument is an easily overlooked feature. Lava domes rise only 30 to 50 feet above the surrounding terrain. Built of compact lava, some of the lava domes have miniature spatter cones less than 10 feet high atop them. The lava domes were formed by the continuous welling out of pahoehoe lava from the same point on the surface. Inasmuch as most of the lava flowed away through tubes, the cones are broad but not high. Lava domes occur at Great Owl Cavern and Indian Tunnel.

Some of the most curious oddities found in the monument are the lava bombs, which range in length from half an inch to as much as 8 feet and have a diameter of a quarter of an

Pahoehoe lava along Indian Tunnel trail

inch to 3 feet. There are three types. Spindle bombs are shaped like footballs and were formed as a clot of lava was hurled spiraling through the air a short distance. Some had long, slender tails, which, broken-off and 3 to 10 inches in length, are known as ribbon bombs. Another kind of ribbon bomb was formed when two clots of lava, traveling at differing speeds or in different directions, were pulled apart. These longer ribbon bombs average 2 to 5 feet in length but are only a few inches wide.

Bread crust bombs were so named because they look like a loaf of bread. They are light and porous with a cracked skin and were formed by the expansion of gases within a clot of lava during its flight through the air.

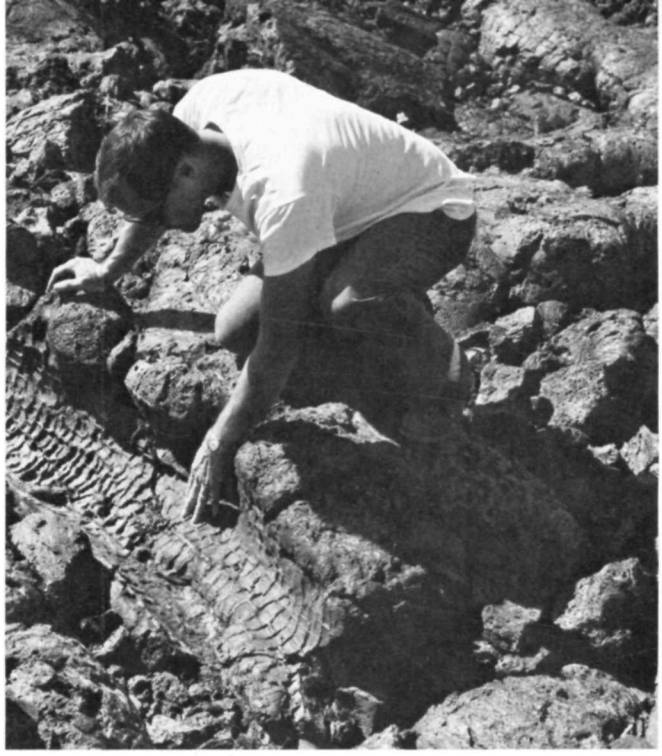
Tree molds are another odd feature found in the monument. In certain places where lava slowly enveloped a forest, having a temperature that was right for the process, perfect impressions of tree trunks and branches were left in the rock as it hardened. Both vertical and horizontal molds were formed. Even the grain of the wood is visible in some of the horizontal molds.

The largest of the lava tubes in the Craters of the Moon is Indian Tunnel, stretching 830 feet under a pahoehoe flow. Great Owl Cavern is a 500-foot-long tube. The smaller caves include Beauty, Surprise, Dewdrop, and Boy Scout Cave, the latter having an ice floor that never melts. Because lava is a poor conductor of heat, it is an excellent insulator. The rain and snow that leak into some of the caves and fissures during the winter freeze into ice which is so well insulated that it never completely melts away. Southern Idaho is a labyrinth of natural iceboxes thus formed. Inside Snow Cone, a spatter cone, is contained a 20-foot-thick heap of ice and snow. The sun's rays are blocked from penetrating to the bottom of these craters by their steep, funnel-shaped sides. The temperature at the bottom never exceeds 40°. The little melting that does occur during warm weather is a slow process.

Because of the extensive fissuring of the ground in the area, water in most places drains away quickly. The only water to be found collects where an ice foundation seals the cracks.

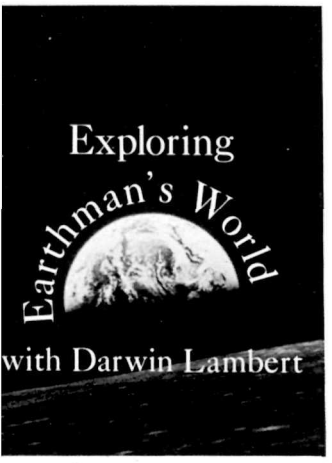
In spite of the inhospitable environment, more than 200 species of plant life and a number of different animals and birds inhabit the monument. The older cinder cones are marked by a larger amount of plant life growing on their slopes. North slopes, because they are cooler and moister, have the most vegetation. Plants have adapted themselves to the lack of moisture in several ways. Some of them put down roots that probe deep or wide. Some have evaporation-resistant foliage. Others are small, thick-skinned, light-colored, or hairy. The dwarf monkeyflower has solved the problem another way. It has no water-conserving adaptations; it grows and blooms rapidly when conditions are right, and then it dies. The resistant seeds then lie in wait for the next rare season of kindness. The best place to observe this continuing vegetable battle against the elements, is along the nature trail in the Devils Orchard area.

Incredible as it may seem, the Craters of the Moon was born, not in violence and turmoil, but quietly, with none of the explosiveness associated with other types of volcanoes. The lava issued sedately, and should the eruptions be repeated today, as scientists feel they could be, it would be possible to walk safely to within a few feet of an advancing flow. ■



Above, mold of a tree enveloped by lava
Below, spindle bomb

Alternating layers of soil and cinders in a roadcut along Broken Top spur road indicate that eruptions occurred at intervals. The thickness of the soil layers suggests long lapses between eruptions.



HISTORY INSCRIBED ON THE LAND

A. Hunter Dupree

HISTORY—THE ACTIONS OF MAN and the marks he has left—has become a part of every landscape. Man does not and cannot live separately from his environment. Each influences the other. Technological activity produces effects that can be described as geological—alteration of Appalachian landscapes by strip mining, for example, or the blights of waterlogging and salinity brought by the British irrigation-and-transportation system in the nineteenth century to the lands of West Pakistan, or unecological forestry causing desiccation and erosion that weakened cradles of civilization.

Purposes and emphases of history have varied. Immediately after the development of writing, successful kings wished to have their conquests recorded for posterity, or their descent connected with eminent ancestors or even with the gods. Herodotus, sometimes called the first historian, later tried to record all kinds of action that he considered significant. Yet the principal emphasis of history through the centuries continued to be on wars and other governmental doings. At some times and places, religious chronicles have been emphasized, and there have been histories of art and other cultural developments. Some writers have seen history as shaped largely by economics or by social systems.

There has probably been too little emphasis on the history of science, on man's discovery and use of natural materials and processes. Certainly, human patterns cannot be understood separately from natural reality, and it may well be that the most lastingly significant events and trends in history are those that change the man-nature relationship. Studied in this light, a civilization may be revealed as containing the seeds of its own destruction, or it may be found to have reached, perhaps by long historical evolution, a workable adaptation to its environment.

Preindustrial adaptations now may not be preservable *per se*, but the introduction of western technology should aim at new balances that utilize science to enhance and not to destroy social and environmental adaptation. The interaction of science, technology, society, and nature—which makes history that is tremendously far-reaching in fundamental ways—might seem discouragingly complex in a short article. So let us try to establish here but a viewpoint—which might prove useful to persons interested in further and deeper exploration. Let us seek the marks of earth-man history and the essence of its meaning in three very different landscapes that exhibit in relatively simple terms the range from the heavy hand of modern technology to the survival of natural conditions.

Landscape 1. A cantilever bridge on one side and a suspension bridge on the other, joined by a two-deck tunnel, dominate Yerba Buena Island in San Francisco Bay. This small island experiences a never-ending sequence of man-directed technological events. Several hundred thousand persons a day, all of them encased in steel artifacts called automobiles, fleetingly inhabit the island, expending much energy and producing considerable amounts of atmospheric pollutants. Yet a fringe of vegetation manages to survive, and the waters of the bay are not yet completely devoid of life. An ecological balance is possible in such a technology-dominated setting only because of a plentiful supply of wind from the ocean, a swift tidal current in that part of the bay, and most importantly the fact that people leave the island as fast as they arrive.

Landscape 2. The Llano Estacado—the high plains of Texas and New Mexico—is one of the most nearly level, least-eroded stretches in the world. A photograph taken from an Apollo capsule in earth orbit shows almost a complete absence of identifiable natural features such as mountains and rivers. Yet the hand of man shows clearly. Section lines, visible as old fence rows and roads, quilting the landscape in precise rectilinear patterns where groundwater encouraged agriculture, reflect not only the work of anonymous farmers but also that of the drafters of the Land Ordinance of 1785. The shape of the area-measure celebrates the lasting influence of Spanish culture, and the now-visible straight line of the Texas–New Mexico border reflects the work both of the surveyors and of the faltering statesmen who drew the line on the meridian of a map as part of the Compromise of 1850. From orbit, all that shows here is earth-man history.

Landscape 3. Olympic National Park is a likely place to look for pure nature, a landscape untouched by man. But take a close look. Start from Whiskey Bend as the trail clears of snow, hike up the Elwa River, over the Law Divide and down the North Fork of the Quinault River. No structures except a few shelters get between the observer and nature for the whole north-to-south traverse of the park. Yet the very ability to observe implies that man has been here. Fresh saw-cuts show that the trail crew has gone before, and the trail down the Quinault is an engineering work in its own right with grades, bridges, cuts, and fills. Even the Olympic park blends man's history with earth's. The very idea of a park implies human decision and expenditure of energy to protect nature. A chain of decisions leading back to creation of the National Park Service is a part of earth-man history, exhibiting the hand of man through the very naturalness of the national parks.

In each of these representative landscapes we thus find not two systems—the ecology of nature and the economy of man—but rather only one system. Technology, as man's way of interacting with his environment, is part of all three scenes. Yet the vegetation on Yerba Buena, the groundwater that brought the quilting of the Llano Estacado, and the stability of the Olympic rain forest continue to tell of the natural forces of earth.

Beginning with isolated examples, we may learn that man and nature affect every landscape, their energies blending in different proportions and in a complex variety of ways that influence, most basically, the course of history. We may thus confirm that the true mission of ecology is to weigh both the natural and the technological forces that shape environments. We may also perceive that a significant part of the true mission of history is to study and record the continuing story of man's effects on his home planet and of natural reality on the long-term actions and well-being of man. ■

Dr. Dupree is George L. Littlefield Professor of History at Brown University, Providence, Rhode Island. As a historian, Dr. Dupree is a pioneer in studying history as written on the earth itself—what might soon become an important new discipline, perhaps known as "environmental history."

ATTWATER'S PRAIRIE CHICKEN

v. w. lehmann

BUREAU OF SPORT FISHERIES AND WILDLIFE

"I WILL TAKE THIS OPPORTUNITY to say that it is *still possible* to prevent the Texas coast prairie chicken from becoming extinct, but . . . a closed season is the only thing that will prevent their extermination. . . ." So wrote H. P. Attwater, the early Texas naturalist after whom the Texas coast prairie chicken was named, in 1930. "Professor" Attwater had been pleading for protection for the prairie chicken since 1916. A closed season finally was granted in 1937, six years after his death.

In 1937, the Attwater chicken—close relative of the greater prairie chicken and of the extinct heath hen of Martha's Vineyard—already was gone from Louisiana, having disappeared about 1919. About 8,700 chickens remained in Texas. But now there are only about 1,400. Something more than protection from shooting obviously was (and still is) necessary to insure their existence.

The history of the Attwater chicken *(Tympanuchus cupido attwateri*-Bendire) is a classic example of what usually happens when a wild species is largely ignored by a state game department—and virtually all other public and private conservation agencies—for a very long time. As far back as 1936 I asked William J. Tucker, Executive Secretary of Texas' first Game, Fish and Oyster Commission, why Attwater's early pleas for action in behalf of the prairie chicken went unheeded. With characteristic candor, he replied that sound politics required a state agency to center its attention on species of greater general interest, such as the bobwhite quail, white-tailed deer, and wild turkey. Until very recently, the Texas Conservation Department did so. That any prairie chickens remain today actually is a tribute to the chicken's own tenacity and to the efforts of a handful of private individuals who practiced better-than-average land stewardship before "ecology," "total environment," and "endangered species" became household words. Among these enlightened individuals were I. V. and Gardner Duncan and David Winterman of Eagle Lake; and Roger Williams, Thomas O'Connor, Jr., Leo and Billy Welder, Dan Braman, and J. M. Tatton of Victoria.

As its name implies, the Attwater chicken is a bird of the prairie. Native grasses and forbs of the prairie, in fact, constitute the only habitat capable of satisfying all of the chickens' needs continuously. All prairie vegetation is not equally productive, however. Diversity within the grassland type is highly desirable.

The mating season of the Attwater chicken begins in late January or early February when males congregate on courtship or "booming" grounds. Courtship grounds vary in shape, elevation, and size (usually 1 to about 10 acres), but they have one common characteristic: a scanty plant cover or no cover at all. But the females which are attracted to the courtship grounds by the spirited fighting and "booming" of the males cannot nest with high success in scanty cover. Consequently, clumps or islands of medium to tall grass—preferably located half a mile or less from the booming grounds—also are necessary.

Though hens evidently prefer to nest in medium to heavy cover, chicks are escorted from dense cover soon after hatching. Preferred pasture for young birds is short (and preferably green) ground cover overtopped by tall weeds, especially when this vegetation grows around rainponds, drainage ways, or windmills. Broods frequent such areas from May through early September.

From late fall through winter, the cover needs of the Attwater chicken are less rigid than at other times. However, pastures with herbaceous cover that is either uniformly tall and dense or uniformly scanty are unlikely to hold high popula-

tions. Islands of short cover are desirable at all seasons, for chickens need such spots to "dry out" after rains, heavy dews, and frosts.

"Weeds" (forbs) as well as grasses are essential in the prairie flora. In addition to providing attractive shade, escape cover, and roosting sites, forbs are imperative for food. Of 56 known plant foods of the Attwater chicken, 43 are forbs.

It is small wonder that prairies of the upper coast of Texas were the center of early chicken abundance. There true prairies—"meadows rimmed by woodland" as they were called by the early settlers—varied in size from hundreds to thousands of acres. But each prairie was separated from its neighbors by fringes of deciduous trees which provided rather effective natural fireguards. As prairie fires were frequent in early times, fire, natural plant succession, and the vagaries of Texas rainfall offered the highly mobile Attwater chickens about any combination of prairie plants they might desire. The popular concept that flat lands bordering on the Gulf of Mexico once were a limitless sea of uniformly tall dense grass is a myth which handicaps both range management and game management in the present.

It is difficult to establish the former range and former numbers of the Attwater chicken precisely, but one can be sure that the largest and most stable populations were on the middle and upper coastal prairies of Texas (from about the Nueces River northward) and in southwestern Louisiana. At least 8 million acres of prairie habitat were occupied, and chicken numbers doubtless approached and perhaps exceeded a million in "good" years.

Long-term trends, in both numbers and occupied range, have been downward. The approximately 8,700 birds found in Texas in 1937 had decreased to approximately 4,200 in 1950, 3,560 in 1956, 1,335 in 1963, and 1,070 in 1967. In 1937, chicken range embraced approximately 450,000 acres. By 1967, chickens remained on only approximately 234,000 acres. Population decline thus was approximately 88 percent and range shrinkage approximately 50 percent in only three decades.

Important factors bearing on prairie chicken decrease have been many, but none has been more serious than the expansion of rice farming, which has deprived the chickens of thousands of acres of prime habitat. In the important prairie chicken range of northeastern Colorado County, for example, more than 12,000 acres of especially choice bluestem prairie interlaced the rice fields north of the Colorado River in 1937, and the prairie chicken population was at least 500. But about 8,000 acres of this prairie sod had been turned by the plow when the area was reexamined in 1963. Meanwhile, chickens had decreased to approximately 200.

Approximately 38,000 acres of the Garwood Prairie in southeastern Colorado County supported nearly 500 chickens when studies began in 1937. Nearly all this prairie was under rice cultivation by 1963, and only about 25 chickens remained. Now there are none.

While rice farming has been perhaps the single most important factor in prairie chicken decline, it has not been the only adverse influence. In 1937 prairie chickens were most numerous (4,242) in northern Aransas and eastern Refugio counties, territory where rice farming so far has been unprofitable. Even so, agriculture has taken a toll. In 1937 approximately 5,000 acres of the 42,000 acres occupied

DEPARTMENT OF SPORT FISHERIES AND WILDLIFE

by the chickens was in domestic crops—corn and milo maize—and the net effect on chicken welfare probably was good. But where a little is good a lot may be tragic. More than 7,000 additional acres of fertile high-ground prairie—superior territory which held one chicken per 5 acres—was planted to grain in 1955. Chickens since have not built back to former densities on this land or in any surrounding territory. The modification of such key wildlife range can and often does trigger far-reaching chain reactions.

But in the Aransas-Refugio chicken colony, factors other than agriculture also have been at work. In 1937, for example, oil and gas development was intensive on only about 2,500 acres. Now it is intensive on more than 14,000 acres. A drainage ditch 12.6 miles long was built through the heart of the best chicken range in 1928, thus drying up many prairie ponds with their encircling rims of shrubs and tall weeds where chickens congregate in summer. However, scores of attractive ponds remained until the ditch was enlarged and lengthened in the 1950s. The late 1950s brought additional adversity: aerial spraying of pastures for weed control (with 2,4-D and 2,4,5-T) and of cropland for insect control (with DDT, aldrin, heptachlor, malathion, toxaphene, and so on).

Weed spraying further decreased vital summer cover, reduced natural food, and otherwise adversely affected the ability of the range to support large numbers of prairie chickens on a continuous basis. Also, residues of agricultural chemicals are now common in the tissues of road-killed chickens found miles from land which had been treated with hard pesticides. The net effects of pesticides on prairie chickens cannot yet be assessed. The fact remains, however, that chickens have picked up poisons in Refugio County and in every other locality where specimens have been obtained, so there is no cause for complacency in the matter.

The once-open chicken range is more crowded, and with organisms that hardly promote prairie chicken welfare—humans. Population increase has been substantial along the

entire Gulf Coast, but it is best illustrated by changes in Harris County. In 1937 the city of Houston embraced 46,630 acres of prairie chicken habitat. Houston now sprawls over more than 286,000 acres of former prairie. And where were the National Aeronautics and Space Administration installations located? Smack in the middle of Harris County's best remaining chicken range.

Fur animals were valuable in the 1930s, and ranch employees often trapped raccoons, opossums, and so on for Christmas money. Many ranches also were worked by commercial operators. But varmint trappers now are almost as rare as buffalo hunters. And feral house cats, skunks, raccoons, opossums, and coyotes—all of which sometimes prey on nesting chickens—are more numerous than prairie chickens virtually everywhere.

A new and possibly serious predator also has emerged. In some of the chicken range, particularly in northwestern Aransas and eastern Refugio counties, it now is quite usual to see upwards of 300 feral hogs in a day. Hungry hogs hardly can be expected to refuse chicken eggs.

Overgrazing by cattle still is common, particularly in territory east of the Colorado River. Furthermore, a great deal of territory east of the Brazos River has been "improved" for cattle by replacing the native prairie flora with coastal bermuda grass and other introduced grasses. Benefits for cattle, when realized, do not extend to prairie chickens. The exotic grasses may provide cover or food for part of the year, but they cannot sustain the chickens throughout the year as can the varied natural prairie.

Not all of the factors mitigating against the survival of the Attwater chicken, however, are man-made. In 1961 Hurricane Carla inundated much of the best chicken range in Chambers, Jefferson, and Galveston counties; chickens were extirpated. Beulah, another killer hurricane, dropped 16 to 28 inches of water on the prairies of Aransas, Refugio, and Goliad counties from September 20 through September 25, 1967. Prior to the deluge, this territory may have held as many as 1,500 chickens. When flood waters subsided, extensive aerial counts resulted in a population estimate of 250.

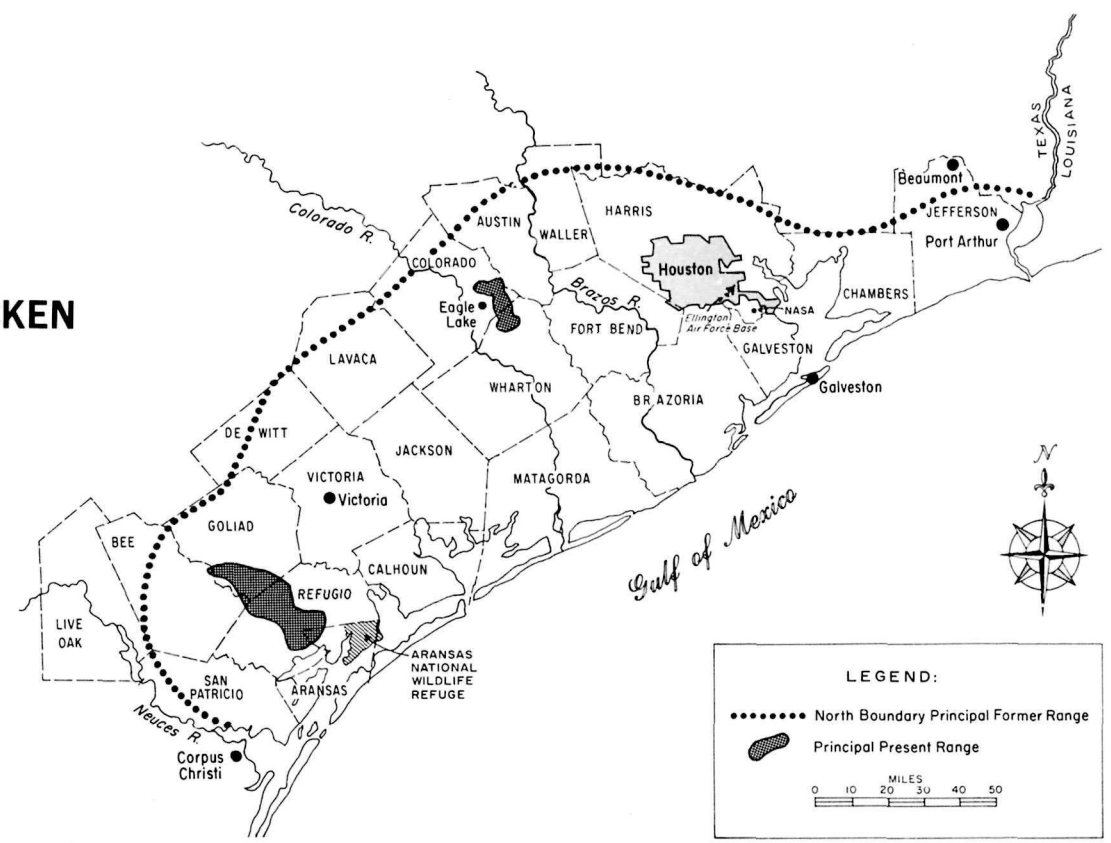
Near-catastrophe sometimes is necessary to stimulate constructive action, and Hurricane Beulah had that effect. Representatives of the Texas Parks and Wildlife Department, the World Wildlife Fund, Texas A&M University, the Wildlife Management Institute, the Rob and Bessie Welder Wildlife Foundation, the U.S. Soil Conservation Service, the King Ranch, and interested ranchers attended a conference called by the U.S. Bureau of Sport Fisheries and Wildlife and held at Victoria, Texas, on November 14, 1967. Along with all-too-many "minuses," discussions revealed several encouraging developments.

Progress had been made toward the goal of obtaining two publicly owned research and management areas—places where the needs of the prairie chicken would be paramount to other considerations. The World Wildlife Fund had purchased 3,450 acres near Eagle Lake in 1965. With cattle grazing reduced, prairie chickens had increased from approximately 25 in 1965 to approximately 58. An additional 54 chickens had been counted on adjoining ownerships.

Through the generosity of Mr. and Mrs. J. M. Tatton of Victoria and Corpus Christi, approximately 7,000 acres—some of it choice prairie chicken range—had been donated to the federal government and added to the Aransas National Wildlife Refuge in 1967. Few chickens resided permanently on the area, but management opportunities were considered to be promising.

New tools had been developed for research and management. The helicopter had been proven to be most useful in census work. With a light net attached to a helicopter's skids, chickens could be caught and moved from problem

RANGE OF ATTWATER'S PRAIRIE CHICKEN



areas such as Ellington Field near Houston to more congenial environs. Although habitat had been further reduced in both quantity and quality, many thousands of acres of former habitat were without breeding stock.

Delegates to the conference agreed to divide the task of restoring chickens among themselves. The Department of Range Science of Texas A&M University agreed to study the effects of prescribed burning and of various grazing systems on chicken welfare. The Department of Poultry Science, in cooperation with the Department of Wildlife Science, would attempt to rear prairie chickens in captivity. The Department of Wildlife Science also would begin field studies on various phases of prairie chicken ecology. The World Wildlife Fund made available its refuge near Eagle Lake for these studies. The Texas Parks and Wildlife Department undertook the responsibility of keeping the closest possible tab on remaining colonies of prairie chickens and assigned two biologists to field research on the bird.

Despite budget problems compounded by Hurricane Beulah, the U.S. Fish and Wildlife Service initiated habitat improvements for chickens on the Aransas National Wildlife Refuge. Furthermore, the Bureau requested additional funds for management and land purchase. Slightly more than $250,000 is allotted for land acquisition in 1971.

Last, and perhaps most important, a permanent committee composed of representatives of conservation agencies was established to plan and coordinate the various parts of the restoration effort. The committee members are: Pierce B. Uzzell (chairman) and E. A. Walker (Texas Parks and Wildlife Department); Dr. Ira N. Gabrielson and Howard D. Dodgen (World Wildlife Fund); W. O. Nelson, Jr. (U.S. Fish and Wildlife Service); Dr. Clarence Cottam (Rob and Bessie Welder Wildlife Foundation); Dr. J. D. Dodd, Dr. Hal Irby, and Dr. C. R. Creger (Texas A&M University); Clifford Carter (U.S. Soil Conservation Service); David Winterman and Thomas O'Connor, Jr. (private agriculture); and the author.

Results of the cooperative effort to the present are encouraging. W. C. Brownlee and Royce Jurries, biologists of the Texas Parks and Wildlife Department, have familiarized themselves with practically all of the chicken range. Annual inventory, so vital to proper husbandry, is now a reality. Brownlee and Jurries are using telemetry to study chicken movements and other aspects of their ecology.

Dr. J. D. Dodd and Albert D. Chamrad of the Range Science Department of Texas A&M University have researched the effects of prescribed burning through two growing seasons. Although field data still are being analyzed, it appears likely that prescribed burning—under the right conditions and to the right degree—can be used to benefit both wildlife and cattle.

Through use of the helinet designed by the author, Dennis Brown and other representatives of the Texas Parks and Wildlife Department have trapped 114 chickens from the Ellington Air Base near Houston where their presence on the runways constituted a hazard to astronaut training. Fifty-three birds were shipped to Texas A&M for propagation in captivity. Sixty-one were released on restoration areas in Victoria and Refugio counties.

Thanks to contributions from conservation agencies and from individuals throughout the nation, the World Wildlife Fund property of 3,450 acres near Eagle Lake is free of debt. Furthermore, an all-weather road has been built through the refuge, this through the generosity of Mr. David Winterman of Eagle Lake and the Colorado County Commissioners Court.

The Tatton addition of 7,000 acres to the Aransas National Wildlife Refuge has been securely fenced and crossfenced. A controlled grazing program is under way, together with an experimental management program involving artificial booming grounds and food plantings. Additionally, and most important, the U.S. Fish and Wildlife Service presently is in the process of acquiring three tracts of land adjoining the World Wildlife Fund refuge in Colorado County. These purchases will increase the size of the Eagle Lake Refuge to 5,575 acres; the ultimate goal is 10,000 to 12,000 acres managed primarily for prairie chickens.

Lastly, chickens have received an unexpected assist from the U.S. Department of Agriculture. Rice-growing allotments were slashed 25% since 1969. Less land producing rice means more land which can produce prairie chickens. Research in 1972 will concentrate on how this can best be accomplished.

There is one discouraging note in the overall picture. Efforts to produce chickens in captivity by Texas A&M University thus far have been unsuccessful. Most of the wild brood stock has succumbed to common poultry diseases or accidents. Experience gained during the past several years, however, should contribute to future success.

Management-oriented biologists feel that, to the present, too little attention has been devoted to the testing of promising management techniques such as the development of artificial booming grounds; prescribed burning on a scale sufficient to affect overall habitat conditions; and the use of a spot fertilization (plus mowing or fire) to discourage chickens from nesting in low spots, create additional booming grounds, and enhance the overall food supply. All of these potentially useful practices, and more, are scheduled to receive increased attention in 1971.

Contributions to the World Wildlife Fund, Washington, D.C., earmarked for prairie chicken management, would allow development of their refuge to proceed more rapidly; high chicken production is desirable in the shortest possible time. Also, additional research is necessary to produce the tools which interested landowners need for initiating effective management programs on their own account. Most actual and potential Attwater prairie chicken range is privately owned.

While it is not easy for one who has watched the Attwater chicken decline from 8,700 to the present population of about 1,400 to be optimistic, it is heartening to know that concerted effort, at long last, is being exerted in the chicken's behalf. As "Professor" Attwater observed so many years ago, it is *still possible* to save the coastal prairie chicken—but only if a concerned public insists that this is done. Cards and letters to the U.S. Fish and Wildlife Service in Washington, D.C., and to the Texas Parks and Wildlife Department, Austin, Texas, can help to build and sustain support for energetic and effective action. ■

Val Lehmann, a distinguished biologist, is wildlife manager for the King Ranch in Texas, which has one of the largest and best privately financed wildlife programs in the U.S. He has written many articles and in 1970 published his first book, *Forgotten Legions.*

npca at work

NPCA AT WILDERNESS HEARINGS

The Association's views are represented in the hearing records for two proposed wilderness areas in Arizona. Member Robert Lee Coshland, NPCA representative in Arizona, submitted statements in his own behalf in favor of the establishment of the Pine Mountains Wilderness Area and the Sycamore Canyon Wilderness Area to the Subcommittee on Public Lands of the House Committee on Interior and Insular Affairs. On invitation of the committee, NPCA submitted its own statements in favor of the wildernesses and reiterated the points made by Mr. Coshland.

Mr. Coshland endorsed the Forest Service wilderness proposal for Pine Mountain with one reservation, namely that no "vegetative manipulation" be done to increase water yields from the Salt River. He endorsed the government's plan for Sycamore Canyon but urged that it be modified to take in additional land.

NPCA consultant Jonas Morris will testify for the Association at wilderness hearings for Yosemite National Park scheduled for the middle of September. He will also submit testimony for NPCA to a wilderness hearing for Point Reyes National Seashore scheduled for September 23 in San Rafael, California.

NPCA TESTIFIES AT PUBLIC LAND LAW HEARINGS

A bill to establish public land use policy and administrative guidelines is "a long step toward wise use of the resources of these lands" but contains two "notable" deficiencies and several other flaws, according to NPCA consultant Walter S. Boardman. Dr. Boardman testified on the bill (HR 7211) by invitation of the House Committee on Interior and Insular Affairs. Representative Wayne Aspinall, chairman of the committee, also was chairman of the Public Land Law Review Commission. The bill under consideration is designed to implement some of the Commission's recommendations.

"It is noted that the very great problems arising from our mining laws are not considered in HR 7211. . . . HR 1126 by Representatives [John] Saylor and [John] Dingell offers a constructive approach to the problem and might very properly be considered along with this bill under study.

"What seems to be another serious defect of the bill is the failure to provide authority for law enforcement, especially upon lands under the Bureau of Land Management. It is granted [that] there is wording relative to federal, state, and local law enforcement, but where local citizens are raiding or damaging the public lands, local authority is too often on the side of the violator. The Bureau of Land Management should have both the authority and the funds to protect our lands. The bill needs urgently to be revised in this respect."

Other points Dr. Boardman made were as follows:

- The bill states that federal ownership of land should be retained unless "it is conclusively proven" that disposal of land would "achieve maximum benefit for the general public." A few paragraphs later, however, the bill says it is in the national interest to dispose of federal land to state and local governments when the latter "are equipped to provide" programs that require land. "This could open the way for land abuse on a major scale," Dr. Boardman said. He said the second statement in the bill should be deleted or made to conform with the first statement.
- Lands bought by or given to the federal government for specific purposes should not be administered according to multiple use policies. Instead this land should be exempted from multiple use and managed for the purpose originally intended.
- Long-term rather than short-term considerations should rule in deciding what the "dominant use" of an area is and whether the area will be managed according to "dominant use" or "multiple use."
- "While there is no mention of national parks, it is not clear as to the extent to which local interests and multiple-use management might subvert the management of the parks as nature sanctuaries," Dr. Boardman testified. He said that unqualified state control of wildlife on federal lands, for instance, could lead to hunting in the national parks. "While it is acknowledged that this proposed act would contribute substantially to better park management, there needs to be some explicit recognition of the differences in purpose between national parks and monument lands and lands administered for multiple use purposes. There must be no opening of the national parks to hunting."

POINT REYES WILDERNESS PLAN PREPARED BY NPCA

A master and wilderness plan for Point Reyes National Seashore has been prepared by Association consultant Jonas Morris.

"The intrinsic natural beauty and significant scientific values of the national seashore at Point Reyes far outweigh its value for intensive recreation development," the proposal begins. "The seashore, therefore, should be managed largely as a natural area, with much . . . of it being given wilderness status. The great variation in topography and soil of the Point Reyes Peninsula has produced a diversity of forest, beachland, grassland, dune vegetation, and marshes."

In line with long-standing NPCA policy, the plan recommends banning private cars from the seashore and substituting buses, banning all off-road vehicles, and putting campgrounds outside the seashore boundary in the hands of private entrepreneurs.

THE NPCA WILDERNESS PLAN SERIES

The Point Reyes wilderness and master plan is the most recent in a series of NPCA wilderness plans for units of the national park system. They are presented as alternatives to National Park Service plans, which by and large lean too far toward development of the parks for recreation and the automobile.

The Association's series of plans is a consequence of the 1964 Wilderness Act's command to the National Park Service to consider which of the lands it administers should be given wilderness status. Before the 1964 act, the presumption was that national parks should be kept as wild as possible, so there were legitimate grounds for opposing any development in parks. In effect the Wilderness Act allows the Park Service to specify certain areas in each park as *non*wilderness and therefore subject to development for recreation and automobile travel. The Park Service consistently has moved to set aside excessive amounts of park land for development in the master and wilderness plans that it submits to Congress for approval. The Association's wilderness plans are efforts to provide alternatives that preserve more natural values. Having prepared its plans, NPCA attempts to have them substituted for the Park Service plans or, failing that, to have as much as possible of their content incorporated in the final, approved wilderness areas.

DODD TO BE CITED AT CEC LECTURE

Famed cartoonist Ed Dodd, creator of the "Mark Trail" comic strip, will receive an NPCA conservation citation when he speaks at the first of the fall Conservation Education Center series of lectures at the Smithsonian Institution on Friday, September 17. The series is held in the Museum of Natural History auditorium in Washington, D.C.

Dodd will base his talk on his recently published book dealing with careers in conservation. Dodd is the nation's most honored outdoors cartoonist, has written several

books, and has appeared on nationwide television. The NPCA citation, to be awarded by Association President A. W. Smith, is in recognition of Dodd's "dedicated work on behalf of a better environment."

Succeeding programs in the CEC series are a film, "Canny, The Life of a Wild Coyote," October 15; a talk by Marshall Augustine of the Maryland Department of Water Resources, November 12; and two films, "A Matter of Time" and "For All to Enjoy," December 10. The films deal with the effects of environmental changes over a span of a million years and with the deterioration of many of our national parks.

NPCA PRESIDENT IS GARDEN CLUB ADVISOR

NPCA President A. W. Smith has been appointed chairman of the Advisory Committee to the Conservation Committee of the Garden Club of America. Chairman of the latter committee is Mrs. W. L. Lyons Brown of Ashburn, Herod's Creek, Kentucky.

Other members of the advisory committee are Charles Callison of the National Audubon Society; Clarence Cottam of the Welder Wildlife Foundation; James Cogar of Shakertown, Kentucky; Henry L. Diamond of the New York State Department of Environmental Conservation; Loren Eiseley of the University of Pennsylvania; Sydney Howe of the Conservation Foundation; Robert Cushman Murphy of the American Museum of Natural History; Richard Pough of the Natural Area Council; Thomas Richards of the Nature Conservancy; Mrs. Thomas M. Waller of the National Affairs Committee of the Garden Club of America; and William H. Whyte of the American Conservation Association.

WELCOME ABOARD!

NPCA takes pleasure in announcing to its membership two recent staff additions.

Robert Eisenbud, special assistant to President A. W. Smith, was most recently Field Research Project Coordinator for the Ocean Law Program at the University of Miami, which is concerned with legal problems of the use and protection of the marine environment.

John W. Grandy IV comes to the Association from the Department of Wildlife Biology at the University of Massachusetts, and will be the President's administrative assistant, wildlife, as a specialist in wildlife biology and ecology.

GIFT MEMBERSHIPS

Gift order cards will begin appearing in the NPCA Magazine next month for the con-

venience of members who wish to give an NPCA membership for Christmas.

The gift membership program was so well received last year that the membership department was hard-pressed to get all the orders processed by Christmas. We urge members to get their orders in early to avoid the last-minute rush. These gifts not only continue to give throughout the year, but provide your Association with much-needed support. Gift memberships are $10 each and include an attractive Christmas card bearing the giver's name.

CALENDAR BOOK

A calendar book featuring eight full-color wildlife paintings by the famed naturalist-artist James Lockhart will be offered again this year to NPCA members.

The 1972 book contains all new paintings, which are printed on special textured paper with fade-resistant inks and are easily removable for framing. The 8⅞-by-11-inch book contains 26 calendar record pages with two weeks to the page, plus composite calendars in the back for 1971–73. The price of the book will remain at $5.50, plus 25 cents for postage and handling. Because the quantity is limited, members are urged to order early, particularly if the books are to be given for Christmas.

PARK WILDERNESS STUDIES

The first 24 Association studies on wilderness in units of the national park system are now available in book form under title of *Preserving Wilderness in Our National Parks.* Slightly abridged, but with photographs and reproductions of original mapwork, the 122-page volume may be ordered from Association headquarters in Washington at $3.95 per copy, postpaid.

conservation news

REACTOR COOLING SYSTEMS DOUBTED

Citing inadequacies in emergency safety systems, a group of scientists from the Boston area has called on the Atomic Energy Commission to stop issuing operating licenses to new nuclear power plants.

A report issued July 26 by the Union of Concerned Scientists referred to a series of tests performed in November and December 1970 by AEC's National Reactor Testing Station in Idaho. On each trial of a small model, the vital emergency core cooling system failed to function properly. The emergency system backs up the primary cooling system that circulates water around the reactor core, where the extremely hot nuclear reaction takes place. If the primary system should fail, the emergency system is supposed to flood the core with water. In the Idaho tests, however, only the first 10 percent of the emergency cooling water injected into the reactor model reached the core. Without coolant the heat of the core would be sufficient for the uranium fuel quickly to melt and breach the reactor containment vessel, dispensing a deadly dose of radiation to the surrounding area.

After keeping the test findings quiet for almost half a year, recently resigned AEC chairman Glenn Seaborg mentioned the results in a May 3 letter to the Joint Committee on Atomic Energy. On June 19 the AEC announced interim criteria for nuclear power plant operations, pending further study of the emergency core cooling systems. These criteria call for lowering the maximum operating temperature of the reactor. However, older plants that cannot meet the criteria are allowed 3 years to modify their equipment.

AEC downgraded the importance of the Idaho tests because they were performed on a 9-inch reactor model that is mechanically simpler than reactors in power plants. Unfortunately for the public, tests of the emergency system on a working reactor—still much smaller than power plant reactors—are not scheduled until 1974 or 1975.

The emergency core cooling system failings raise grave questions among environmentalists. For years conservationists looked to nuclear power as the clean, ethical alternative to damming streams and burning coal to get electricity. If nuclear power indeed is unsafe, as increasing numbers of scientists and citizens are convinced it is, we are left with no existing environmentally acceptable means of generating electric power sufficient to meet our nation's great demand.

UAW'S WOODCOCK BLASTS INDUSTRY'S ENVIRONMENTAL "GAME PLAN"

Leonard Woodcock, president of the United Automobile, Aerospace, and Agricultural Implement Workers of America (UAW), recently urged legislation that would "give workers, individually or as a class, the right to sue their employers for damages in situations where the workers

lost wages, fringe benefit protections, or seniority rights because of plant shutdowns or layoffs resulting from pollution of the environment by their employers."

This proposal was made in a letter to Maine Senator Edmund Muskie. In the letter Woodcock expressed concern that American industry was developing a new environmental "game plan" for dealing with cleanup orders from the government. Under this "game plan," Woodcock asserted, employers told to comply with government antipollution standards try to "enlist workers, their unions, and their communities in campaigns of resistance to enforcement of those standards." This enlistment effort, he said, would be helped along by "overt or implied threats" that enforcement of the standards would result in shutdowns and layoffs.

Later, in hearings before Muskie's Air and Water Pollution subcommittee, Woodcock continued to push his idea. He upbraided the Nixon Administration for two-facedness on the pollution question.

"What we have today," he said, "is not an environmental policy but an environmental politics . . . merely the old politics of corporate irresponsibility. . . . Mr. Nixon thoughtfully assured many of the major industrial polluters in the country that his administration would not 'beat industry over the head' to obtain employer compliance with antipollution standards. He was ominously silent with respect to the police measures his administration would take to prevent industry from beating workers over the head with the threat of plant closings and job losses if the government presses for an end of industrial pollution. We have seen no broken heads among the managements who continue to pollute our common resources of air and water; but workers all over the country can already see the club over *their* heads."

Woodcock quoted extensively from remarks by Henry S. Houthakker, a member of the President's Council of Economic Advisers. Houthakker criticized uniform ambient air standards for the whole nation. "It is conceivable," he said, "that a depressed area may want to attract industry at the expense of a less-stringent ambient air standard. . . ."

"If this proposition," Woodcock testified, "is translated . . . into plain language, it emerges as the old and ever-new government-industry partnership against the unorganized, the unemployed, the poor, and their communities. . . .

"The Houthakker doctrine . . . implies more than an invitation to the unemployed to breathe polluted air if they want jobs and three square meals a day. It also constitutes a warning to employed workers already breathing polluted air . . . in exchange for jobs. That warning is clear: cough and visit your doctor regularly, but don't get environment-happy or we may have to shut down the operation and move away."

Woodcock said his proposal would end this strategy and "create a new and powerful financial incentive to induce polluting employers to step up to their environmental responsibilities."

TOWPATH PLAQUE HONORS JUSTICE WILLIAM O. DOUGLAS

A fine tribute was paid Justice William O. Douglas of the Supreme Court on June 13 by the Chesapeake and Ohio Canal Association when a bronze plaque in his honor was unveiled at the Canal Towpath and 31st Street in the Georgetown section of the District of Columbia. Kenneth S. Rollins, immediate past president of the Association and chairman of the ceremonial committee, presided. Congressman Gilbert Gude of Maryland and Smith W. Brookhart, Association president, expressed appreciation for the sustained leadership Justice Douglas has given to the citizen efforts to preserve the Canal from destructive enterprise.

In his acknowledgment, Justice Douglas observed that thousands had shared in the annual canal walks and in bringing about the enactment of legislation establishing the C & O Canal National Historical Park. He urged the National Park Service to make facilities available to the children of the inner city.

While it was a nostalgic occasion for

those present who had been on the original hike in 1954, it was clearly evident that Justice Douglas was looking to the future and was deeply concerned lest the people relax their vigilance in protection of the Canal as a sanctuary from the noise and confusion of city life; that threats from projects of the Army Engineers and commercial-type developments by other agencies must be resisted even more strongly than in the past.

CANNIKIN BAN REQUESTED

The Environmental Coalition for North America has asked President Nixon to cancel the prospective Cannikin nuclear blast at Amchitka Island in Alaska's Aleutian National Wildlife Refuge.

In an early August letter to the President, the Coalition cited both certain and possible hazards of the huge blast, now scheduled for October by the Atomic Energy Commission. Among certain hazards, ENCONA said, are adverse impact on the peregrine falcon, eagle, sea otter, and other island wildlife, and on aquatic life of the vicinity. Among possible hazards would be triggering of large earthquakes, initiation of tidal waves, venting of radioactive gases, and radioactive contamination of ocean waters.

The letter suggested that cancellation of the shot would be a valuable gesture toward a ban on underground testing, furthering prospects for strategic arms limitation.

COASTAL OIL PLANT REJECTED IN MAINE

Many concerned citizens on the upper Maine coast, and others elsewhere in the state, have been opposing issuance of a license by the state's Environmental Improvement Commission for construction of a $150 million oil desulphurization plant at Sears Island, in beautiful Penobscot Bay. The island is presently uninhabited. Recently the commission refused to issue such a license on the grounds of severe hazard to the coastal environment.

Lest there be any premature cheering on the part of conservationists in Maine or elsewhere, however, it should be pointed out that the matter is open to review in the Maine courts. This admonition is passed on to us by Marshall F. Burk, executive secretary of the Natural Resources Council of Maine. The council has been a focal point for opposition to the Sears Island plant as well as to other big oil installations on the Maine coast which have the potential for enormous oil-spill damage and other pollution of an environment that is still relatively unscathed by industrialization. The council has taken the position that it is not opposed to the concept of economic betterment in Maine, but that economic development should be consistent with the state's long-range environmental well-being.

conservation docket

The National Park Service will hold public hearings on its plans for designated wilderness in two park units during September. For Yosemite Park, hearings will be held September 11 at the U.S. Forest Service Mammoth Visitor Center, 40 miles north of Bishop, California; on September 14, at the Yosemite Valley Visitor Center; and September 16 in the California Hall Auditorium in San Francisco. For Point Reyes National Seashore, hearings will be held September 23 in San Rafael. NPCA will present its views at both of these wilderness hearings.

Bills have been introduced in both Houses to amend the Internal Revenue Code of 1954 to permit certain tax-exempt organizations, including conservation organizations, to engage in communications ("lobbying") with legislative bodies, and committees and members thereof. The bills, S. 1408 and H.R. 8695, have been referred to the Senate Finance Committee and the House Ways and Means Committee.

Recent legislative activity in the Congress on various conservation questions has included:

- H.R. 10090, making appropriations for the Atomic Energy Commission for fiscal 1972 with a modified Inouye amendment barring funds for the Cannikin test shot without Presidential approval; passed by the Senate.
- S.J. Res. 52, to increase authorization for comprehensive planning grants and open-space land grants, passed the Senate without amendment and was sent to the House.
- H.R. 9037 and 9767, requiring the Interior Department to issue a new draft environmental impact statement on Alaskan oil pipeline and to require Congressional approval before construction, were referred to the House Interior and Insular Affairs Committee.
- H.J. Res. 3, to establish a Joint Committee on the Environment, passed the House and was referred to the Senate.
- S.J. Res. 115, instructing the Secretary of State to call for an international moratorium of 10 years on killing of all whale species, passed the Senate.

The following new park legislation has been proposed and referred to the Senate and House Interior and Insular Affairs Committees:

- H.R. 9786, to authorize a feasibility study of a Channel Islands National Park in California.
- H.R. 9761, authorizing acquisition of additional land at Houghton, Michigan, for Isle Royale National Park, to provide more parking space for persons visiting the island park by boat.
- S. 2272, providing facilities and services not otherwise available to visitors in Park Service areas by authorizing the Interior Secretary to guarantee loans which are part of concessioner investments in the facilities.
- H.R. 9629 and S. 2949, to authorize a Tallgrass Prairie National Park in Kansas.
- S. 26, 29, and 30, to revise Canyonlands National Park boundaries, establish Capitol Reef National Park, and establish Arches National Park, were passed by the Senate. The House Subcommittee on National Parks and Recreation has begun marking up a similar bill, H.R. 9053.

New legislation on national recreation areas and national monuments, referred to Senate and House Interior and Insular Affairs Committees, is:

- S. 1977 and H.R. 8763, to establish an Oregon Dunes National Recreation Area and to prohibit mining in the area.
- H.R. 9273, for the establishment of a Connecticut River National Recreation Area in several of the New England states.
- H.R. 9859, to establish a Cumberland Island National Seashore in Georgia.
- H.R. 8756 and S. 1927, providing for a Hohakam Pima National Monument in Arizona.
- S. 2141, to establish a Desert Pupfish National Monument in California.
- H.R. 9661, establishing a California Desert National Conservation Area from 12 million acres of public lands.

A bill to establish a new national wildlife refuge has been introduced in the Senate and referred to the Committee on Commerce:

- S. 2241, to establish the San Francisco Bay National Wildlife Refuge, of 21,662 acres on the southern tip of the bay.

Other legislation of conservation interest includes S. 488, to prohibit licensing of hydroelectric projects on the Middle Snake River until 1978, passed by the Senate; and S. 717, to establish a Hells Canyon-Snake National River. This bill will be heard September 16 and 17 by the Senate Subcommittee on Parks and Recreation.

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of overlapping problems, and that they plan their recommendations in the hope that the results of the separate meetings will fit together harmoniously.

The same is to be said of the forthcoming United Nations Conference on Population in 1974. Not a single issue which will come before the Conference on the Environment, nor indeed the Conference on the Law of the Sea, but will have its roots in overpopulation. The two earlier conferences can be set within a perspective of an open-ended expansion of world population, in which event their discussions will be fruitless, or within a hope of stabilization and eventual reduction of population.

We are well aware of the difficulties of stabilizing population, even in the United States in 50 years, and in the world as a whole within 150 years. And yet a drastic reduction in normal family size could be accomplished very rapidly if adequate educational work were done quickly enough, essential clinical assistance were provided, a small family maximum moral norm could be established, and rational supporting governmental institutions could be created. The point for the Conference on the Environment is that the imperative need for population stabilization must be a presupposition of all thinking there, as well as a recognition of the possibility of such stabilization.

A drastic reorganization of worldwide institutions and procedures with respect to environmental protection must follow rapidly upon the heels of these three interrelated world conferences. The operations of the World Health Organization (WHO) will have to be reoriented toward environmental medicine; that is, protective inoculations must be substituted as rapidly as possible for the control of disease-bearing insects, such as the mosquito. The insects are becoming immune, and the intolerable poisoning of the environment which the insecticides are occasioning must cease.

The projects of the Food and Agricultural Organization (FAO) must be revolutionized in the same way, in the direction of ecological agriculture. The new varieties of rice and wheat are a great boon, and will buy a little time for the solution of other problems. Profoundly dangerous, however, is the abuse of pesticides and fertilizers which now accompanies them. Ecological agriculture requires a rapid shift from broad-spectrum persistent pesticides toward narrow-spectrum nonpersistent insecticides, and, since these also carry grave consequences to life, toward biological controls. Agricultural administrations which cannot understand the imperative nature of these requirements must be replaced by institutions with broader perspective and greater understanding.

The policy-making institutions of the United Nations as a whole must begin to lay down policy requirements binding upon the specialized agencies, and the Member Nations must give them the authority to do so. Decisions of this kind must come out of the great conferences which are to be held during the course of the next three years. Immediately ahead, of necessity, is the grand historical task of creating the worldwide institutions which are essential to cope with all of these pressing problems of environment, development, and population.

The conference procedure is an excellent means for taking the first steps toward the critical goals. But comprehensive treaties should also emerge from the conferences which will outline objectives and policies, and create administrative, regulatory, monitoring, and enforcement institutions of an executive nature.

Hopefully the treaties will provide for the establishment of tribunals with power to interpret and enforce the covenants by which they were created, thus enlarging the indispensable judicial element of a representative world government; such tribunals, from their respective areas of responsibility, should be brought under the central review authority of the International Court of Justice, the jurisdiction of which should be enlarged step by step for that purpose.

Only by such procedures can mankind hope to expand the scope of world law and order, as contrasted with present-day world anarchy, in military, economic, humanitarian, and ecological matters.

The notion that sovereignty is being surrendered is a bugaboo. The exercise of sovereignty includes the power to cooperate with neighbors; in that sense sovereignty is self-limiting. An inalienable element of sovereignty is the power to enter into treaties whereunder the parties agree not to exercise unlimited sovereignty in other respects.

Obviously there are dangers in the establishment of large worldwide institutions; their bureaucracies will be cumbersome; their technocracies will be arrogant; and the miscellaneous plutocracies of the nations will strive for undue influence. But these are the problems which beset all governmental institutions, national and international alike. The answer lies in full participation by the peoples of the world through normal representative processes and through collateral action by nonprofit, nongovernmental organizations.

—*Anthony Wayne Smith*