

OUR NATURAL RESOURCES:

THE CHOICES AHEAD

United States Department of the Interior Conservation Yearbook Series No. 10

1974



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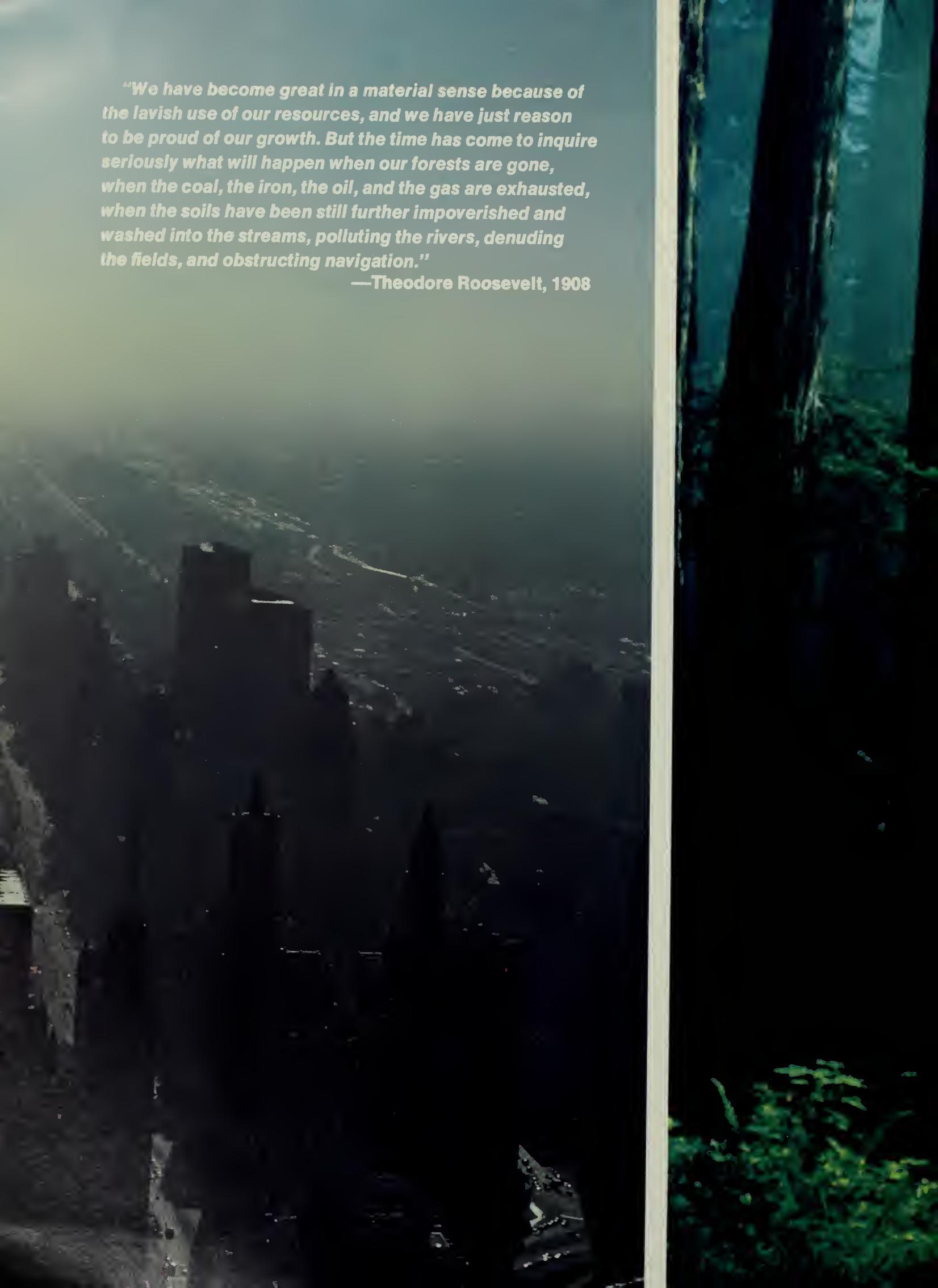


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"We have become great in a material sense because of the lavish use of our resources, and we have just reason to be proud of our growth. But the time has come to inquire seriously what will happen when our forests are gone, when the coal, the iron, the oil, and the gas are exhausted, when the soils have been still further impoverished and washed into the streams, polluting the rivers, denuding the fields, and obstructing navigation."

—Theodore Roosevelt, 1908



"The tendency nowadays to wander in wildernesses is delightful to see. Thousands of tired, nerve-shaken, over-civilized people are beginning to find out that going to the mountains is going home; that wilderness is a necessity; and that mountain parks and reservations are useful not only as fountains of timber and irrigating rivers, but as fountains of life."

—John Muir, 1901

Rigorous Conservation, Responsible Development

The two quotations above could as well have been voiced today as when they first appeared more than half a century ago. Almost from its inception, the conservationist movement encompassed two principal concerns: (1) the need to prudently develop, manage, and utilize the Nation's natural resources, both renewable and exhaustible, in order to assure long-term supplies of materials; and (2) the need to provide a quality environment in which Americans could enjoy the beauty and wonder of the natural world, while living in surroundings that were clean, healthful and attractive.

Until recently, however, these two concerns were rarely seen to be related. They simply coexisted, side by side, for several decades, as several separate constituencies moved toward a variety of conservation objectives. The achievements of these groups, though largely unconnected, were many and impressive.

The National Forest System was established, enlarged, and improved. The National Park System was created and parks multiplied and became an increasingly popular American

Chicago skyline 1973 (left) and Redwood National Park, California.

institution. A network of migratory bird sanctuaries was organized, and protection was offered an increasing number of endangered bird and animal species. Giant flood control programs got under way and large areas of the West were made fruitful and productive through irrigation and cheap electric power. Wasteful drilling and production practices in the Nation's oil and gas fields were sharply curtailed.

To the extent that the term "concern" connoted apprehension, it was almost entirely identified with the threat of exhaustion of one or more vital resources. Pollution and environmental degradation were viewed mainly as local nuisances—the regrettable but inevitable concomitants of industrial progress. The main threat perceived was that this progress might someday be limited by an inadequate supply of resources.

The national preoccupation with this threat rose and subsided periodically with the public's experience with shortages, real or imagined. The early fears voiced by Theodore Roosevelt at the White House Conference of Governors in 1908 were dissipated in the following years, to return briefly under the stress of the supply and demand dislocations of the First World War. There followed a period of worry over oil supply in the early 1920's when it appeared that the demands of the burgeoning automobile population would outstrip the supply of petroleum—a concern which evaporated with the large discoveries of oil a few years later.

The heavy supply strains of the Second World War revived the general apprehension over resource exhaustion and led to President Truman's appointment of a commission to examine the supply and demand outlook for energy and materials. The report of this commission (the so-called Paley Report) which was issued in 1952 shed a great deal of light on the Nation's resource position and proposed a number of recommendations to avert some of the shortage situations it foresaw in the future.

By the beginning of the 1960's, however, almost every commodity was again in plentiful supply and many were in surplus, and the Nation's resource problems came increasingly to be

related not to the scarcity of materials but to their sheer abundance.

The number of automobiles doubled between 1950 and 1970. A prolonged expansion in building increased the number of dwelling units by half in this same period, while per capita income increased by two-thirds in real terms. Farms dwindled and cities grew. A vast interstate highway system was built which made it possible for a family to drive from coast to coast in a week, and the general level of prosperity gave large numbers of them the time and the money to do so.

Surfeited by the city and bored with what it had to offer, millions of mobile, well-heeled Americans took to the roads, hoping to find peace, tranquility, and just plain breathing space in some park or forest or recreation area.

They found other things, too: power plants and paper mills, choked and dying rivers, desecrated seashores, acres of rusting automobile hulks, miles of wasted, eroded hillsides, tacky and obtrusive signs and buildings, and litter, always and everywhere. And what they did not see for themselves the ubiquitous television carried to them vicariously.

Thus the ground was laid for the present phase of the conservation movement, in which the concern for environmental quality came to prevail over the strict utilitarian objectives of earlier periods. Even the word "conservation" has been virtually displaced by "environmental protection" as the operative term describing the objective of the current effort. In the affluent setting of the sixties, the evident concern was not the traditional one of resource exhaustion. Initially it was simply the thought that the environment should be not only useful, but clean, healthful, and attractive. But as knowledge grew of the workings of the earth's ecological systems, the evidence mounted for the case that if the environment were not kept clean, healthful and attractive, it would eventually cease to be useful as well.

The decade of the 60's accordingly saw a steady rise in environmental concern which the initial Departmental Conservation Yearbook, issued in 1965, appropriately described as a Quest for Quality. This thrust proceeded along two principal avenues: pollution abatement, and



Seeking escape from urban pressure, Americans took increasingly to the road but often encountered choked rivers, rusting automobiles, and eroded hillsides to increase their concern for environmental quality.





U.S. YEARLY GROWTH

YEARLY GROWTH PATTERNS

1 Million young people enter the labor force

3½ Million new Americans are added to the population (New births and immigration)

2 Million new households are created with potential of further population growth

YEARLY GROWTH DEMANDS

1 million new jobs

FOOD, ENERGY, AND MATERIALS OF ALL KINDS

the enlargement of recreational opportunities through dedication to wilderness, park and recreational areas of extensive tracts withdrawn or purchased for this purpose.

By the early 1970's, however, the concern for environmental quality had been overtaken and rejoined by the older apprehension over the ultimate exhaustion of resources. By 1973 the United States was dependent upon foreign sources for more than half its supply of 20 vital minerals and more than a third of its petroleum. More to the point, these same commodities—and others—were being eagerly sought by many other nations in a crush that drove prices sharply upward. The dramatic way in which the oil exporting nations demonstrated their monopoly control over the world's petroleum supply is a sign and symbol of the approaching scarcity of a resource of critical importance to the United States and to the world. Other nations with raw resources to sell may profit from this example.

These developments and others have given rise to the neo-malthusian conviction that this time we really are approaching the bottom of the resource barrel and that the ultimate villain is growth—economic and population growth—which is responsible for the decline in both environmental quality and the availability of resources.

In this rationale, it is exponential growth which is the root of the relentlessly increasing demand

for materials of all kinds, which in turn causes ever greater portions of the land to be ripped open, paved over, and otherwise exploited to support processes which ultimately inflict increasing quantities of polluting waste products upon the air, water, and soil. And it is exponential growth, according to this view, which will ultimately undermine the Nation's capacity to provide the resources for its needs on any terms save a catastrophic reduction in population or standards of living, and probably both.

The zero-growth movement is a specific manifestation of this developing concern, but its ramifications extend far beyond the immediate influence of the fully-committed practitioners of that philosophy. Throughout the Nation there is a discernible reluctance to permit growth to continue on anything resembling the terms of the past.

People in resource-rich regions are increasingly militant in their attitude toward sharing their patrimony with other parts of the Nation. Sectional disputes are beginning to appear over who gets the resource and who gets the pollution. The prevailing attitude that established residents in many communities communicate to outsiders is that "this is a nice place to visit, but you wouldn't want to live here." Undoubtedly if asked, most of the people involved in these fencing-out efforts would report themselves as wholly in support of growth,

America's future depends heavily on oil, gas, coal, electricity, and other resources called energy. Make no mistake—we have a real energy problem. One-third of our oil—17 percent of America's total energy—now comes from foreign sources that we cannot control—at high cartel prices costing you and me \$16 billion more than just a year ago.

The primary solution has to be at home. If you've forgotten the shortages of last winter, most Americans have not. I have ordered today the reorganization of our national energy effort and the creation of a National Energy Board. It will be charged with developing a single national energy policy and program.

President Gerald R. Ford
Before Joint Session of Congress
October 8, 1974

(The President named Secretary Rogers C. B. Morton to head the national energy program.)

progress, and prosperity insofar as the Nation was concerned; “but, you see, we’ve got a different situation here . . .” What is good for the country is evidently not good for Cicero Falls.

Yet the denial of growth flies in the face of reality. Every year, at least a million new jobs must be found for young people entering the labor force; 2 million new households are formed, and 3½ million new Americans arrive by birth and immigration who must be fed, clothed, housed, and otherwise cared for the rest of their lives. For the next half century, at least, our population will continue to increase, and with it the demand for energy and materials of all kinds.

The real question to be answered is not whether growth will be permitted, but how, within what limits, and under what conditions. This, the tenth in the annual series of Conservation Yearbooks published by the Department of the Interior, addresses itself to some of the tasks of reconciling growth with the objectives of environmental quality and resource conservation.

Difficult and complex choices lie ahead, involving sharply competing and equally legitimate claims upon the Nation’s limited supply of land and water.

How do we determine priorities for the use of these two fundamental resources for the production of energy and minerals, for parks and recreation, for the preservation of woodlands, rivers, and wildlife in their natural state for the

enjoyment of future generations?

How can we meet the steadily increasing demands of our people for material things with the minimum damage to our environment?

In a world which is reaching hungrily for materials of all kinds, how do we minimize our dependence upon scarce and vital minerals which are now supplied us from foreign sources?

The succeeding chapters of this Yearbook describe the programs and actions that are being undertaken by the Department of the Interior in order that essential growth may proceed without waste of our resources and further deterioration of our environment. Within the limited context of specific programs, many choices must necessarily be made. But in the wider view there is no choice at all. Rigorous conservation and responsible development of our precious natural resources and the preservation of a clean and healthful environment are not competitive but complementary demands upon our capacity to manage our affairs. We must provide for both, or we shall soon find ourselves unable to provide for either. That is the message of *Our Natural Resources: The Choices Ahead*.

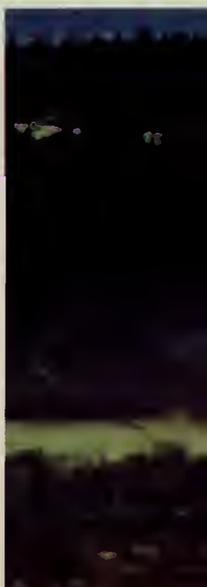


Secretary of the Interior





WHERE ARE
THE
RESOURCES?





Avoiding a Minerals Crisis

By Alan Cole

Our Nation has been blessed with vast natural resources and we have acted to protect them by making conservation a priority goal. Even so, development of domestic mineral resources is not keeping pace with domestic demand.

The gasoline shortage is one illustration of our growing resource supply problem. Last year, we found ourselves suddenly short of an important raw material—crude oil. The ensuing fuel shortage problem still is with us, though its crisis dimensions have been reduced.

The prologue to our oil shortage went something like this: In the past few years, domestic demand for products refined from crude oil reached new annual highs at the

same time that domestic production was leveling off. To meet demand, crude oil imports were increased. Abruptly, several foreign suppliers halted shipments. The result was an instant shortage whose economic impact spread like the ripples from a rock thrown into a pond.

Now, we must broaden our activities to avert another potential crisis: A general shortage of minerals, especially metals. Experts in



the Interior Department's Bureau of Mines who watch carefully the international trends in mineral development are warning of possible mineral shortages. As with oil, a more concerted effort has to be expended to forestall such a situation.

We've become accustomed to having our industries supply whatever we want. If the item isn't available within our boundaries, we assume that some foreign country

will provide it in exchange for Yankee dollars. This system has worked well, and the prices we paid for minerals remained remarkably steady for many years, but recent experience suggests that we may

have become overconfident about our minerals position. Our future acquisitions of manufactured goods can be influenced greatly by the

Many common items we use every day could be in short supply if minerals crisis overtakes the United States on broad front.

relative abundance or scarcity of minerals.

Natural resources are often spoken of as the "lifeblood" of modern industrial economies. America's standard of living grows because the Nation uses natural resources in massive amounts. Natural resources are the primary source of all wealth, and mining and agriculture are the basic activities that convert natural resources into usable forms.

For minerals, we start with "resources," add geological and mineral expertise, and get "reserves"—usually that amount of a resource that can be processed with today's technology at today's prices. Mineral reserves are converted into mineral raw materials by our "extractive industries," or mining companies.

Other firms, our "mineral processing industries," convert mineral raw materials into energy and processed minerals. Then, the "manufacturing industries" take over to produce the thousands of items that society uses to establish a standard of living.

We *depend* on minerals. In 1972, on the average, each U.S. citizen required 40,000 pounds of new mineral materials, plus about 18,000 pounds of mineral fuels—coal, petroleum, natural gas, and uranium. These fuels generate energy for doing work—energy equivalent to that expended by 300 persons working around the clock for each of us!

To become fully convinced that ours is a mineral-based economy, look at the record in 1973, when the U.S. used more than 4 billion tons of *new* mineral supplies. Besides that, we recycle large amounts of selected metals (\$2 billion worth in 1972).

Some minerals are not found in this country in economically workable concentrations. They are easier or cheaper to obtain from deposits in foreign nations. Consequently, imports supply large percentages of total U.S. demand for

several minerals. Those important in a wartime economy are stockpiled by the Government.

Unfortunately, a nation's wealth can be spent and dissipated, and the sources of its wealth can be depleted. When this threatens, adjustments are necessary. One option is to do with less; another is to find new sources by exploration at home and purchases abroad. A third option is research. Research can improve technology so that production from current reserves can be increased. Research can reduce costs so that marginal domestic resources can be brought into production. Research can provide substitutes for materials that are in short supply and second uses through recycling.

Currently, we are working on all these options. For some raw materials (oil, for instance) we are tightening our belts. Though exploration and research are in progress, neither offers what could be called short-term solutions. So, our commercial firms actively seek more foreign concessions.

Keep in mind, however, that our population is only 6 percent of the world's. And the other 94 percent of the people on earth want to improve their standard of living. Many formerly undeveloped countries have begun to industrialize. As a result, worldwide demand for energy and minerals is rising rapidly. This means competition for us as we try to supplement domestic resources through imports. Foreign competition diminishes our ability to pay for foreign raw materials. It aggravates our balance of payments problems. Facing such problems, however, we are still in a race to keep up our economic growth. Moreover, we are committed to do so without damaging our environment.

Growth is another way of saying "greater demand and higher output." When future growth patterns are forecast, significant increases in demand for energy and minerals

appear in the crystal ball. In 1950 the U.S. used 2 billion tons of new minerals. In 1972 it was 4 billion tons. In 2000 it may well be 11 billion tons. Projections of domestic production also show increases, but we can foresee demand increasing at a greater rate than that forecast for domestic supply. That means deficits—\$40 billion in 1985, and nearly \$100 billion in the year 2000—unless we soon change the picture.

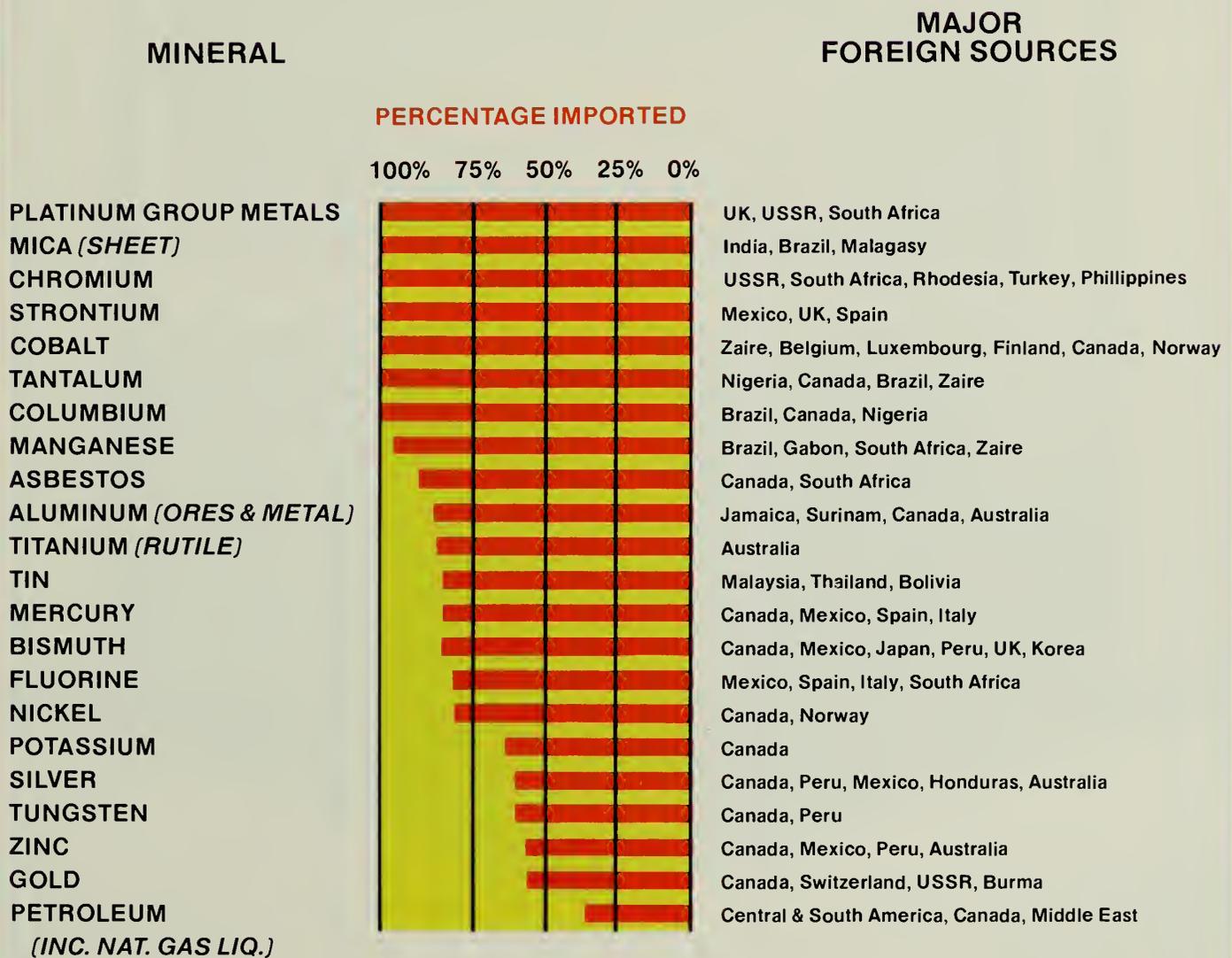
Fortunately, our own resources of many important minerals are not small. In fact, they are large enough to justify hope that domestic production could be increased beyond our current projections.

Our mineral resource position is basically sound. Looking to the future, data on "reserves" are important for the near-term. But, to balance our minerals "budget" over the long term, it is imperative that we constantly shift resources into the reserve category. We can do this by advancing our technology, exploring successfully for new deposits, and by maintaining a sound economic climate.

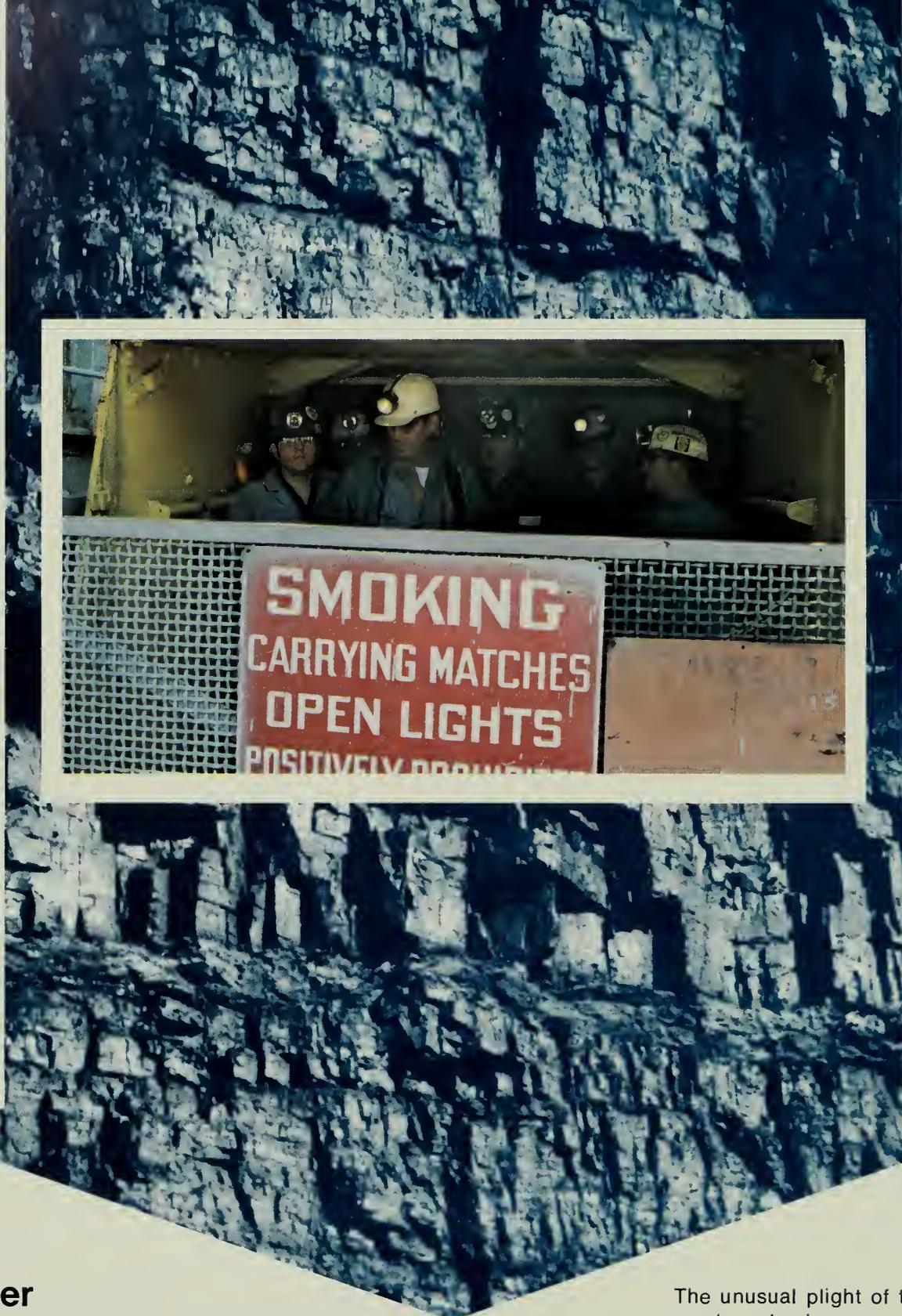
In summary, the U.S. minerals position is by no means hopeless. The whole world is entering a phase of new relationships, and we are in the thick of the adjustments that are taking place. Domestically, we must forget the conveniences of a "throw-away" society, change the pattern of over-dependence on foreign supplies, and rededicate ourselves to the challenge of developing the technology we need to sustain our standard of living and to maintain economic growth. It is essential, too, that we develop, and apply with ever-increasing sensitivity, the incentives that can properly direct American investment toward more effective development of America's resources.

To make that possible is, in a very real sense, the mission of Interior's Bureau of Mines.

MINERALS IMPORTED FOR U.S. USE IN 1973



The United States depends on foreign sources for more than half of its total supply of 21 vital minerals and more than one-third of its petroleum supply. Our mineral imports outstripped our mineral exports by about \$8 billion in 1973. Rising foreign industrial development means higher demand for minerals. U.S. trade deficit in minerals could reach \$100 billion annually by 2000 unless our domestic resources can be bolstered.



A Better Break Below

By Edward M. Bender

Some hazard is associated with almost every industrial job, but underground coal mining is one of the few occupations in which the worker may be exposed to many industrial hazards at the same time. Name a hazard; it's probably in an underground mine—explosives,

toxic and explosive gases, flying and falling objects, poor visibility, dampness, bad footing, dust, noise, nauseating fumes, heavy moving and stationary machinery, cramped quarters, poor communications, protruding sharp objects, and high voltage—an imposing list, to say the least. Men who work inside the earth digging coal may daily face some of these hazards.

The unusual plight of the underground coal miner was given national recognition when Congress passed, and the President signed, the Federal Coal Mine Health and Safety Act of 1969. In this legislation, Congress clearly indicated its desire to get more health and safety into the mines immediately, as much as possible with the technology then available.

And to assure the continuing development of new technology for improving mine health and safety,

the Secretary of the Interior is ordered to conduct "... such studies, research, experiments and demonstrations as may be appropriate." The Act authorized for this purpose as much as \$75 million for allocation before June 30, 1972, and up to \$30 million each year thereafter.

While other agencies in the Departments of Interior, and of Health, Education, and Welfare, set standards, inspect mines, and generally administer the Act, the Bureau of Mines alone was given responsibility for research and technological development. This challenge—to improve the environment of the coal worker through technology—brings with it an almost unlimited opportunity for innovative, creative research and development. The amount of research money made available by our lawmakers showed plainly that they recognized the state of mine health and safety and judged it criminal to expose today's workers to such conditions.

Faced with such questions as "We know how to keep a man alive on the moon and on the ocean floor, why can't we mine coal without killing and maiming workers every year?," the Bureau determined to learn as much about the underground as is known about the environments fabricated by man for space and undersea exploration.

For this task, Bureau engineers and scientists selected eight atmospheric conditions that contribute to hazards underground, and planned a mine air surveillance system to provide information on each and to warn when a hazard appeared to be developing. Besides the accumulation of knowledge, the goal was to be a reliable, inexpensive system that industry could begin to use with the least possible delay. Therefore, the contractor, who was to design, assemble, and install an experimental system, was ordered to use only sensors, gages, and instruments whose worth was already established, and which were already being manufactured.

The equipment was to monitor continuously for methane, hydrogen, smoke, carbon monoxide, temperature, rate of temperature change, velocity of ventilating air, and noise. A prototype system, specifically designed to do all of these things, is now being tested at the Bureau's Bruceton (Pa.) experimental mine.

Bringing the most modern technology to mine health and safety, this electronic system is controlled by a computer in a "command post" on the surface. Linked to the computer are sensors for measuring the eight selected conditions at ten stations throughout the mine. For reliability, both primary and backup circuits are provided. Readings on the eight critical items at all ten stations are processed without interruption by the computer and displayed on the control panel in the command post. Also, readings at each individual station are displayed on a sensor cabinet at that station.

Whenever the computer data indicates that a possible hazardous condition is developing anywhere, the command post operator is alerted by unmistakable signals. He can set in motion appropriate actions to correct the situation or remove the men from the mine. Voice communication between a sensor station and the command post, as well as between stations, is also provided.

Hopefully, tests now underway will prove the value of air surveillance to mine health and safety and will result in a reliable, relatively inexpensive model that can be rushed into service in mines throughout the Nation.

When methane is released during coal mining, it is a potential explosion hazard in underground mines. The usual practice is to lessen the danger by moving the gas away from the coal face—where the coal is cut—with fresh air drawn through the mine by massive fans. While diluting the gas

with fresh air and venting it from the mine allows mining to proceed, the technique is costly. Sometimes, unfortunately, explosions occur.

Obviously a safer, cheaper, less wasteful technique is needed.

Drawing on its years of laboratory experience with methane, the Bureau of Mines postulated a method for draining most of the gas from a coalbed before mining would begin. With less gas to be released at the coal face, there would be less chance for an accidental ignition.

With funds provided under the 1969 Act, the Bureau arranged for an on-site degasification demonstration at the Eastern Associated Coal Corporation's Federal No. 2 Mine in Monongalia County, West Virginia. First, a large, 839-foot-deep hole was bored from the surface into an unmined section of the Pittsburgh coalseam where the coal is eight feet thick. The borehole was enlarged to 14 feet at the bottom, and seven long, horizontal degasification holes were drilled out into the coal like spokes from a wheel hub. Because this was a controlled experiment, the bottom of the hole was fitted with piping, valves, and gages, to measure such things as gas pressure, flow rate and quality, and to carry the gas to the surface for safe venting.

But why waste the gas by venting it to the air? After all, Bureau researchers reasoned, methane from a coalbed is essentially the same as natural gas, and the country was in the midst of an energy shortage. The new "well" was producing a lot of high-quality gas at a steady rate, a better producer than many commercial wells; and there was a commercial natural gas pipeline only 400 feet away.

The gas collection system was already in place. The venting system was just begging for a hookup with the pipeline. The opportunity was clear: a chance to advance safety and conservation with a single stroke.

Although the setup seemed to be made-to-order, several months of legal investigations and negotiations were required before an agreement could be reached and the hookup could be completed under the supervision of Bureau engineers. Then, at 2:30 in the afternoon on January 28, 1974, mine gas removed from a coalbed to make mining safer was, for the first time in history, tapped into a commercial pipeline distribution system. It worked without a hitch!

Only later, when they read about it in their newspapers, did long-time gas customers learn of the innovation.

"I couldn't tell any difference in the flame or the heat," one housewife commented. "It was just gas, like we've been getting all along from the pipeline. You know, it comes from Texas or Louisiana, or someplace down there. Coming right at the time everybody's talking about a gas shortage, I think it's just grand!"

The Bureau of Mines thinks so, too—a real step forward in the conservation of natural resources. But even more important, income from the sale of the gas could be used by mine operators to offset the cost of a methane draining system.

Mine gas is potentially dangerous, but it can be used safely as a fuel. In 1974 mine gas removed from a coalbed to make mining safer was tapped for the first time into a commercial pipeline distribution system.



This single experimental borehole now adds more than 750,000 standard cubic feet of gas every day to the fuel-short economy of the Northeastern States, enough to meet the daily cooking needs of 18,000 average households. And, it is doing so at a time when the accomplishment can be fully appreciated by the public.

The Bureau estimates that the Nation's natural gas reserves would double if all the methane locked in coalbeds could be economically extracted. But, before this methane can be counted as an energy resource, more mine operators will have to adopt some type of methane drainage system using gas collection systems, and a commercial pipeline or consuming industry will have to be reasonably close.

The Bureau is firmly convinced that the methane drainage concept is an important advance in coal mine health and safety and should be adopted for that reason alone. Nevertheless, there are other advantages. For example, Bureau researchers now describe their drainage well as a "multipurpose borehole." They point out that, after degasification is completed and mining starts, the well can be used successively as a fresh air intake, a return airway, an emergency escapeway, and finally, as a channel for degasifying the gob—the mined-out areas underground. All are facilities that have to be provided during underground mining. And in the gob degasification stage, the well might even become a commercial gas producer again.

So methane drainage should not be viewed only as a health and safety cost, but also as an income producer and a system for doing work that has to be done sometime during mining anyway. Not to be overlooked by the operator is the fact that degasified coalbeds can be mined faster.

Then, too, "a better break below" makes for a more effective work force.

First a cracking sound that quickly builds to the thunder of falling rock . . . then clouds of dust that settle slowly into darkness and dead silence. That is the signature of a roof fall.

Sudden collapse of the mine roof on unsuspecting workers is one of the leading causes of fatalities and injuries in underground coal mines. For many years, post and beam supports were used to try to keep the mine roof in place. More recently, roof bolting has become popular, and millions of bolts are installed every year to tie the layers of mine roof together and make them self-supporting.

Despite extensive timbering and bolting however, roof falls occur often enough to rank this hazard first or second, year after year, as a cause of death in the mines. Roof falls seldom rate national coverage in the news. They generally kill one, two, or three at a time, fewer than the five that marks a mine accident as a disaster, and it takes the word "disaster" to spark nationwide concern.

But roof falls do get top billing in Bureau of Mines research, where studies range from the theoretical to the practical. The Bureau's rock physics studies, for example, seek the fundamental reasons for rock fracture, as a first step toward the discovery of a method for predicting rock falls. Bureau development of protective techniques and equipment, on the other hand, is in response to the immediate need for getting more health and safety underground.

Because roof conditions vary from mine to mine, and even from place to place within a mine, no single protective practice is universally effective. So, Bureau researchers are experimenting with a variety of promising methods for reducing the frequency of roof falls.

In one project the Bureau is adapting a support system used in European mines so that it will be practical in America's mines. The



Steel canopies project from two movable roof supports being readied for Bureau of Mines "shortwall" mining demonstration.

system gives protection at the coal face, one of the most hazardous places for roof falls because new, unsupported roof is continuously being uncovered. In practice, a series of huge hydraulic jacks with protruding canopies are set side by side to extend a protective steel covering over the heads of men and equipment at the coal face. The European jacks had to be modified for use with the continuous mining machine, an American development which contributes greatly to high productivity in our underground coal mines. The jacks are now being tested in a Kentucky mine. In another project, shotcrete, a sprayable cement, is being applied to strengthen and seal surfaces in mines where the rock deteriorates when exposed to air.

But regardless of how well these and other Bureau experiments work out, it appears that, for safety's sake, some roof bolting will always be needed. Consequently, the Bureau has a continuing project aimed at improving roof bolting technology. An example of this work is a machine, operated by remote control, for drilling holes for the rock bolts. This development allows the operator to do his work in safety, under a secure roof. Also, work is progressing on equipment that will safely insert a roof bolt in very thin seams of coal where the bolt often is longer than the height

of the mine passage. When this happens, bolts are bent by hand, inserted into the hole, and then straightened by bending them back against the side of the hole. This action may dislodge loose rock, resulting in injury or death, and may weaken the bolt. The new device will be operated remotely, removing the operator from the danger zone, and it neither kinks nor weakens the bolt.

Of special interest currently is perfection of "pumpable" rock bolts and the equipment for installing them. A mixture of fiberglass strands and a material something like epoxy resin is forced into drill holes. Penetrating the pores and minute cracks in the rock, pumpable roof bolts quickly harden into a supporting mechanism that allows less roof sag than conventional bolts. Also, the bolts hold firm and do not loosen after they have been installed for a while. Demonstration by the Bureau of a remotely operated machine that both drills the hole and fills it with the resin, without exposing the operator to an unsupported roof, is expected to open a new era of safety underground.

An experiment to strengthen a badly fractured area before it is mined was suggested by the success of the pumpable rock bolt. Where the ground is weak to begin

with, the roof may start to cave before temporary supports can be set. Even after supports are installed, pieces of loose rock falling from between supports can be dangerous. Mechanically anchored bolts may lose their effectiveness in such conditions. Searching for a solution to this problem led the Bureau to try drilling holes from the coal face, at an angle, so that they entered the roof rock above the unmined coalbed. The epoxy-type resin was then injected into the holes and was allowed to set before the roof was exposed by mining. The result was a considerably strengthened roof; however, more testing will have to be done before the real value of this technique can be established.

These are only a few of the many Bureau of Mines projects aimed at making life a surer thing for the miner. In health and safety terms, today's mining technology leaves a lot to be desired, and the Bureau works on a broad front toward many specific goals.

The Bureau frequently demonstrates its newly developed technology in operating mines. The objective is to stimulate interest in new methods for improving health and safety conditions, and thus speed the introduction of proven technology where it daily will help save lives.

Miner applies sprayable cement called "shotcrete" on the roof and rib to seal out air and add strength.





Treasuring Our Trash

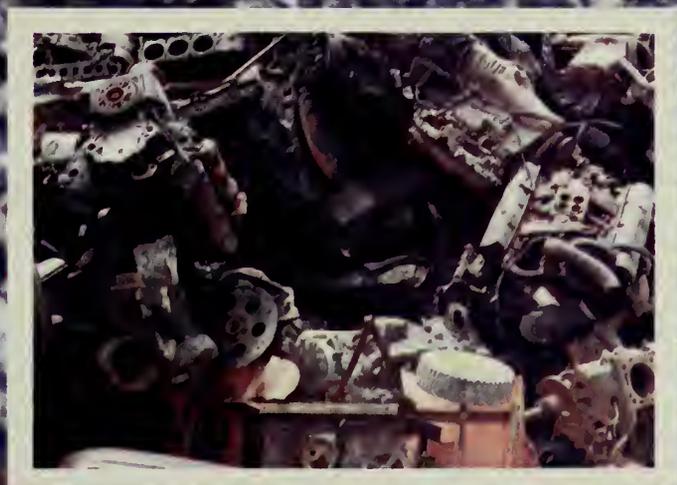
By Maria Friedman

Cincinnati, Ohio, in many ways is a typical American city—a medium-sized industrial center with strong pioneer roots, sustained by the

river on which it grew. For Cincinnati, the mighty Ohio River was for years a vital artery supplying the necessary mineral raw materials to the city's varied industries. As times and technologies changed, Cincinnati's search for supplies extended beyond the reaches of the river, and new supply routes brought minerals from great distances. The pattern is a familiar one across America.

But in a few years Cincinnati and many other American cities may be able to obtain a substantial portion of their mineral needs in their own backyards. Lying fallow under the noses of city dwellers are vast, self-renewing "deposits" of iron, copper, zinc, lead, tin, and other minerals, deposits richer in metal content than many ores mined commercially today.

What is this treasure trove? Ac-



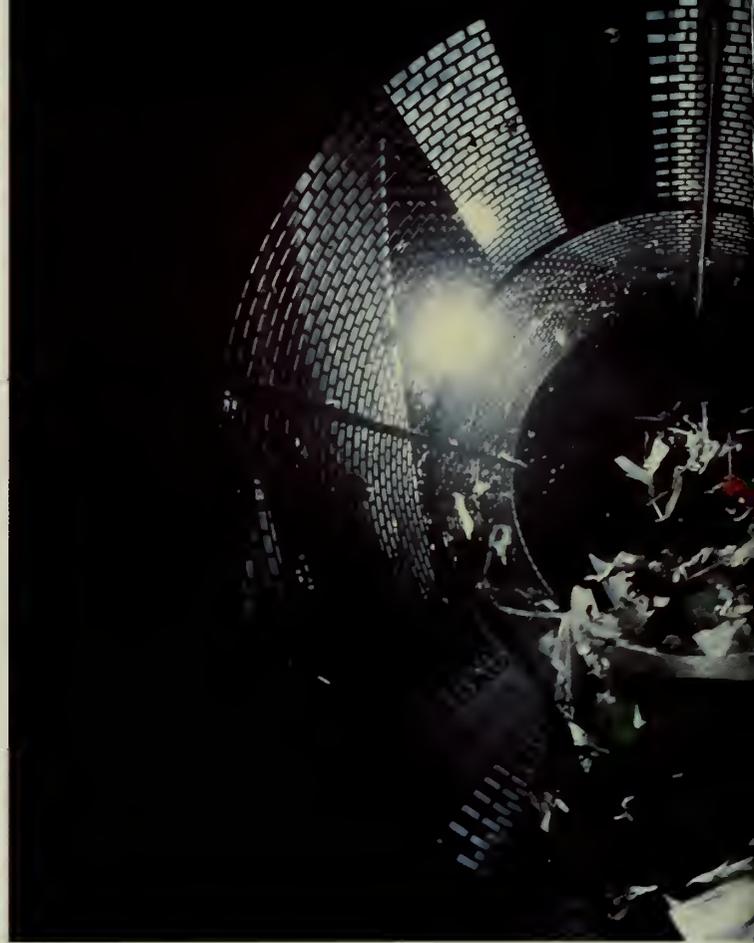
According to the Bureau of Mines, it is trash—that hodge-podge of paper, garbage, metals, glass, and plastic potentially worth nearly \$2 million each year to cities like Cincinnati. Using these wastes could conserve energy and open up new sources of minerals and materials to supplement the Nation's dwindling natural resources.

Unfortunately, many Americans have not yet awakened to the ne-

cessity and potential of waste recycling. The recycling incentive and know-how have been lacking in many cases. As a result, urban and industrial discards have simply been wasted—left to pollute the air, land, and water.

What is needed is a technology that can put these wastes back to work for us, and that is what the Interior Department's Bureau of Mines is developing, a technology

Separating waste materials for re-use today largely is a matter of hand-sorting. For total recycling, better ways are needed. Bureau of Mines researchers are following several experimental approaches toward development of continuous, automatic waste separation techniques to convert trash into treasure—in the form of reusable minerals and clean fuels.



Household trash (left), fed onto a conveyor belt of an experimental machine at College Park, Maryland . . .

that will turn America's trash into America's treasure while cleaning up the environment. Actually, the techniques that form the basis for this technology are borrowed from the mineral industries—they are methods developed years ago to recover valuable minerals from ores. The techniques proved so successful that the Bureau "recycled" them to cull valuable mineral-based materials from the vast tonnages of urban and industrial wastes generated each year.

A major problem with recycling wastes is that, like ores, they are mixtures—the valuable materials must be separated in order to be used. Neighborhood recycling centers attempt to sort the small percentage of the wastes they collect, but these operations are small-scale and cannot possibly cope with all the ingredients found in common urban refuse.

Bureau scientists turned to mineral technology and came up with a gigantic mechanical "unmixer"—a pilot plant capable of processing the 260,000 tons of wastes gener-

ated annually by cities the size of Cincinnati. Using conventional ore processing machinery, the refuse is shredded and run through a series of magnets, air blasts, screens and other operations to separate the 1,820 tons of nonferrous metals, 19,825 tons of recycleable iron, 30,875 tons of glass, and 200,000-plus tons of paper and plastic found in a year's worth of trash.

The total value of these products is an estimated \$1,832,000. After subtracting the \$520,000 estimated annual operating costs for the Cincinnati-sized reclamation plant, the annual profit would be the neighborhood of \$1.3 million.

The practicality of such an operation has not yet been proved, however. It would depend, in part, on the sale of the materials recovered from the trash. Most of the metals, particularly iron, have traditionally enjoyed ready markets and are now in heavy demand. But many of the other mineral-based materials in the trash, including glass and plastic, are discarded because they cannot now be made

into marketable products. And no one even thinks of recycling the "putrescibles"—the actual garbage.

Bureau recycling research is changing all that.

Adapting mineral technology to recycling waste glass was especially logical, since glass is made from the mineral silica, the major ingredient in several industrial products.

By using ordinary commercial techniques, waste glass can be recycled into commercial-quality bricks and floor tile, or even a "mineral wool"—top-quality building insulation resembling "angel hair" on Christmas trees. One of the most ingenious reuses of waste glass is a reflecting paint made from pulverized glass fragments. The minute glass particles "sparkle" in the light, making the paint well-suited for marking highway pavements. Economic studies show that these products could actually be produced at a profit.

Bureau recycling ingenuity even extends to the overlooked garbage. Through a Bureau-developed proc-



tumbles through a cylinder called a trommel (center). Small pieces of glass and other trash fall through mesh . . .



and small pieces of paper are drawn up through an air separator and cling momentarily to sides of ducts, leaving at bottom a shining trayful of glass, wood and metal fragments (right).

ess, just about any organic material that might be found in garbage, including the peas that Junior refused to eat, wood chips, or even manure, can be transformed into a low-sulfur synthetic oil suitable for use by powerplants, or for conversion into other fuels. Although this process is not yet economic the potential is enormous. America's two billion tons of wastes per year contain about 50 percent organic matter, and could produce two billion barrels of oil—the equivalent of half the U.S. demand for oil in 1970.

Perhaps the hardest urban waste material to recycle is plastic. Plastics are derived from petroleum and present a unique recycling problem because up to now they have been very cheap, and because they can produce noxious air pollutants when burned. Recent petroleum shortages have proved that plastics are worth recycling, however.

There are many kinds of plastics, which must be separated from each other before they can be reused. The raw refuse reclamation process

only separates the plastics from the other materials in the trash. So Bureau researchers applied another mineral technique to this problem and came up with a way to sort the plastics by their differing buoyancies, a "float-sink" procedure like those used to separate finely crushed coal from waste rock, for example.

But what to do with the "purified" polystyrene, polyurethane, polyvinyl chloride, and nylon recovered by the process? In further research, the Bureau found ways to reuse the plastics. For example, discarded polystyrene—the main ingredient in styrofoam ice chests—can be treated and combined with another kind of plastic to make new foam. And polyvinyl chloride can be used as an easily-transported source of hydrochloric acid, an important industrial reagent.

This research did not go unnoticed, and two of the world's biggest users of plastic, Ford Motor Co. and General Motors Corp., joined the Bureau to find more ways of reusing reclaimed plastics. Mod-

ern automobiles contain a tremendous amount of plastic—the 1975 models might contain as much as 200 pounds of it—and the millions of cars junked each year could become an important source of this indispensable industrial material.

Under terms of the agreements, Ford and GM will furnish the Bureau with cars which, after dismantling and shredding, will become the raw materials for research. In return, the Bureau will share some of its recycling techniques that are particularly adapted to recycling junk cars.

The automobile makers are not the only ones interested in recycling their wastes. Many industries are now recognizing that the wastes from yesterday's operations may be a source of tomorrow's raw materials.

One of the least obvious mineral-rich industrial wastes is the "stack gas" generated by industrial combustion, especially the burning of coal. Millions of tons of sulfur are literally going up in the smoke of metal smelters, coal- and oil-fired



powerplants, and other industrial operations generating the noxious air pollutant sulfur dioxide (SO₂). A new Bureau-developed process "scrubs" the SO₂ from the gases, and then recovers the sulfur in nearly pure form. Not only does the technique retrieve a saleable industrial product, but it also makes the stack gases environmentally acceptable. Field tests of this promising method, called the "citrate process," are now under way.

Zinc is a metal whose price has skyrocketed during the past year. But much zinc is also being wasted in dusts from the gases generated by electric steelmaking furnaces. Until recently, there has been no economical way to recover the more than 50,000 tons of zinc lost each year in this way. The untreated wastes create air pollution during transportation and storage, and cause water pollution if they are washed into streams.

However, Bureau researchers developed a process that recovers the zinc from the dusts. More than 90 percent is recovered as metal equal to a low-grade virgin zinc. Even the wastes from this Bureau process can be recycled again to recover the valuable iron and manganese found in this second crop of leftovers.

Like piles of urban refuse, piles of industrial wastes can be considered "ores" of valuable minerals. For example, Bureau-developed smelting techniques can reclaim millions of tons of zinc, iron, copper, and silver from the residues of obsolescent zinc smelters. The Bureau estimates that the value of

these metals in only one year's worth of residues is about \$25 million. In some areas, the residues have accumulated for decades around the zinc smelters, leaving huge quantities of potential ore.

The minerals recovered from such wastes are valuable in their own right. However, the wastes themselves can sometimes be recycled directly into useful products. Building bricks meeting commercial specifications can be produced from copper and zinc mill tailings—the leftovers from the processing of ores. After the wastes are dried, crushed, and mixed with bonding material, such as cement, they are molded into bricks and steam cured. This is another Bureau development with good potential for commercial application.

Slag from phosphorus furnaces, which currently has no commercial value and constitutes a disposal problem, could be a new source of raw materials for ceramic floor and wall tile. The slag is ground into fine particles and treated to remove impurities. It is then formed into wall tile by dry processing, heating, and glazing. Floor tile can be made by adding other ingredients, such as borax, to the process.

The possibilities for waste recycling are endless. Recycling is a way to attack these problems: waste, pollution and a finite supply of mineral resources. It is a way to help assure that our cities, our industries, and indeed all Americans will continue to obtain essential minerals and prosper without waste and pollution.

Order from chaos: Society's discards are gathered in neat containers from experimental machine—glass in foreground, ferrous metals at left, and aluminum fragments at right. In back are metal objects and collections of paper and garbage.

Recovery of minerals and metals from industrial wastes would give major assistance to national need. Millions of tons of sulfur, for example, are lost each year through smelters and powerplants. Industrial wastes are excellent sources of valuable minerals.





Updating the Changing Environment

By L. H. Borgerding

Once it appeared that the United States always would have an abundance of desirable land and pure water for everyone. Then suddenly, like Rip Van Winkle awakening from his 20-year slumber, we discovered that land and water were not inexhaustible; that something had to be done to make sure that future generations could enjoy some of the same resources that had been so plentiful to us.

Because of metropolitan growth, open land is being gobbled up at

an unprecedented rate. Our cities and suburbs now total 200,000 square miles, almost the size of the combined States of Oklahoma, Kansas, and Missouri. By the year 2000, major urban regions will have expanded to 340,000 square miles. Our Nation will have built again as much urban housing and facilities as presently exist. Greater demands will be made upon less available productive land for food, water, minerals and energy.

Because much information is needed for planning the best use of our land and its natural resources, an updated supply of critical data about our changing environment is constantly needed. To meet the challenge, a number of experimental programs have been developing data to cope with the expanding problem. New tools and methods of application are helping to analyze and predict, mold and



shape the future use of our resources.

To furnish the most accurate information on which to base future decisions is the goal of teams of scientists and engineers. They include cartographers, hydrologists, geologists, geophysicists, seismologists, geographers, urban planners and many other technical and non-technical participants.

Urban planners have long been

accustomed to using the U.S. Geological Survey 7½-minute topographic-quadrangle map at a scale of 1:24,000 (1 inch equals 2,000 feet). The growing pains of our urban areas, however, now call for a new generation of mapping tools and techniques.

For example, when the U.S. Geological Survey, U.S. Department of Housing and Urban Development and the Association of Bay Area

Governments recently initiated a cooperative program to investigate environmental needs and resources of the San Francisco Bay area, they discovered that they would require 196 quadrangle maps. This quantity would have been too cumbersome to use except for precise detailed reports. Therefore, a new map was compiled at a scale of 1:125,000 (1 inch equals nearly 2 miles). New photography was con-



tracted to update older maps, and a three-sheet topographic base map in ten colors was compiled.

Rather than showing the urban areas in a tint, an innovation was adopted to show every street in the city area, no matter how short. The resulting pattern gives an impression of tint, reveals cultural development in a striking way, and provides users with the detail they need for precise planning. Green tints are employed to distinguish parks, forests and game refuges with yellow and orange tints for other features. The result is an "instant" picture of the extent of these lands. Many special purpose maps will be combined with this base— investigations of ground water, surface water, and quality of water entering the bay, for geologic zones including faults, landslides, tsunami-prone areas (zones where "tidal" wave action produced by earth movement or volcanic eruption presents hazards) and for preparing land-use inventories.

One of the first new map products made for the San Francisco project was the orthophotomosaic, which combines high altitude aerial photos with the 7½-minute quadrangle maps. Prepared with the same horizontal requirements to meet national map accuracy standards as the base map, the orthophotomosaic provides a natural look at the ground.

Once the orthophotomosaic is reduced to scale and processed, an orthophotoquad in a 7½-minute format can be produced. The orthophotoquad can be combined with contours, which improves the plotting of information from field observations. Geologists and hydrologists find the result useful as a base map for studying land forms, landslides, water-use, soil erosion, and

flooding. Soil delineations, identifying symbols and enhancement of some cultural details, have been overprinted by the U.S. Soil Conservation Service on the orthophotoquads.

Early in the planning for the San Francisco Bay Area project, a need for a regional slope map was recognized. Slopes could be interpreted from conventional topographic maps; however, urban planning and geological studies required that certain critical ranges of slope be categorized and presented graphically. It was decided that a 1:125,000-scale slope map should facilitate land use classification and also serve as the basis for local landslide and other ground stability studies. Several photomechanical methods of spreading contours were developed to make possible the final production of the slope map. The 1:125,000 scale shows an exceptional detail for slopes in the Bay area. Separation materials for the various colors will permit enlargements to the 1:24,000 scale with precise register.

Slope maps have been found useful for other types of studies. Timber management, fire control, erosion, watershed and irrigation planning, route planning for pipelines, transmission lines and preliminary studies of transportation corridors are examples. Nontechnical map users have found the slope map easier to understand than other types of maps.

As part of the San Francisco land-use mapping project, an enlarged photo map pair of the Hayward, California area at a scale of 1:50,000 (1 inch equals about 4,200 feet) was prepared. The NASA high-altitude color infrared photo was taken on May 15, 1970, and a computer printout map, based on ERTS-1 satellite image of July 26, 1972, was produced. One printout symbol represents about 1.1 acres and symbolizes such urban land use as commercial-industrial (1); mobile homes (V); residential (M);

Maps are important in updating our changing environment. Shown are three examples used by scientists and engineers.

and parking lots (.). Expansion of the mobile home park shown on the computer map was confirmed by the NASA 1972 air photograph.

Such land-use maps are invaluable for studies of traffic flow, daytime population distribution, water-use, identification of prime agricultural land and recreation "green space," changes in water quality, preparation for large-scale emergencies, and for other environmental studies.

Another prototype product of experiments in land-use detection using remote sensors aboard aircraft and earth-orbiting satellite is the Washington, D.C. urban area land-use map. The land use map was compiled by the USGS by relating 1970 census statistical information to USGS land classification and combining the data with a NASA color-infrared photo. In a related but more extensive program, the USGS CARETS (Central Atlantic Regional Test Site) is updating land-use data for a 28,000-square mile area of the East Coast from central New Jersey to southern Virginia. Later overflights will be used to show changes in urbanization by digitizing the data into a computer bank. More recently, a detailed land-use classification experiment was based on a new orthophotoquad of the Fredericksburg, Virginia area.

Experimental large-scale metropolitan mapping studies are presently being conducted in the cities of Fort Wayne, Indiana and Charleston, South Carolina. This mapping is being accomplished by commercial contract under the technical assistance and guidance of the U.S. Geological Survey. Similar research efforts are underway or planned for San Francisco, Chicago, and Frederick, Maryland. The USGS and city engineers will use the maps in making decisions on future programs. Teams from both groups will help determine requirements, identify funding needs and pinpoint areas of technical assistance.

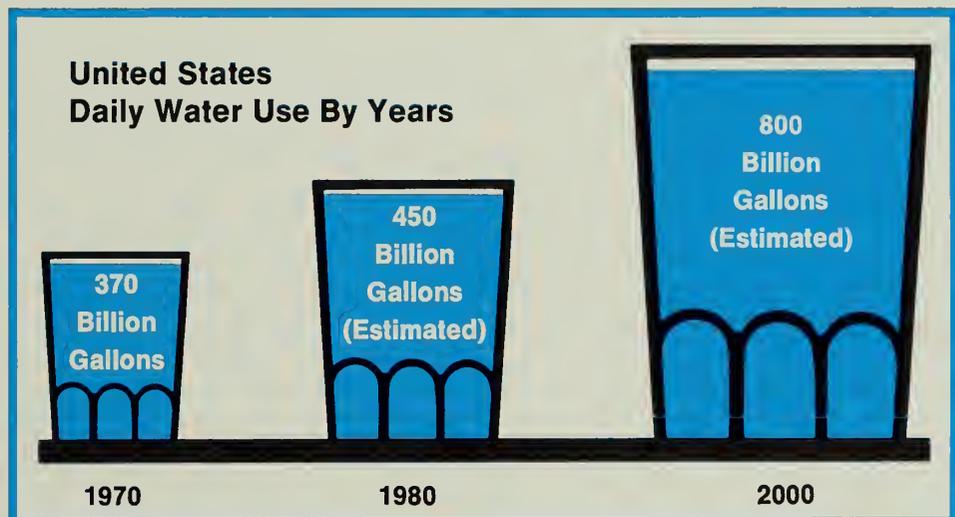
Measuring Our Water Supply

By Jay Humphreys

Each day our Nation funnels 3,170 billion gallons of water—about eight times the average daily flow of the Mississippi River—through its water pipes, turbines, and irrigation systems to meet the needs of our homes, factories, farms, and power plants. Fortunately, most of this water is returned to the water system and is available for reuse. However, in some areas, particularly the Southwest, a growing demand for water from limited supplies imposes a serious strain on water resources.

needs. For example, the average streamflow in the United States alone is about $3\frac{1}{4}$ times the 370 billion gallons per day withdrawn by all users. Stored groundwater supplies are estimated to be even greater than the streamflow. Therefore, there seems to be enough fresh water available to supply our projected needs far into the next century at least, providing we bear the cost of keeping it clean, storing and transporting it and increasingly recycling it.

In cooperation with the Department of Housing and Urban Development, the Geological Survey is conducting a flood-prone-area mapping program to delineate the approximate flood boundaries of streams across the Nation. The in-



Discounting the 2,800 billion gallons of water used daily by the hydroelectric industry, U.S. Geological Survey hydrologists calculate that for each American in 1970 about 1800 gallons of water were used daily for domestic, industrial, rural, and irrigation activities. This means that about 370 billion gallons of water were pumped, piped, or diverted each day. Daily water use is expected to rise to 450 billion gallons in 1980, and may exceed 800 billion gallons by the year 2000.

Despite an increasing demand, our overall water supply is more than adequate to meet foreseeable

formation on flood-prone areas is presented on quadrangle maps which then serve as valuable guides for public agencies and private citizens concerned with land development.

Flood areas have been identified for: (1) urban areas where the upstream drainage basin exceeds 25 square miles, (2) rural areas in humid regions where the upstream drainage exceeds 100 square miles, (3) rural areas in semiarid regions where the upstream drainage basin exceeds 250 square miles, and (4) smaller drainage basins, depending on topography and potential use of flood plains.



Plotting With Images From Space

By Priscilla Woll

Our concern about population growth recognizes not only that our resources are finite, but that known reserves of some essential mineral and fuel resources are fast disappearing. If we need a spur to step up exploration, the knowledge that our reserves are dwindling should provide it.

Our knowledge of deposit locations is limited by our understanding of how deposits were formed, what processes caused their concentration, and what we can use as indicators of a deposit's existence. The relationship between mineral deposits and geologic lineaments as one such indicator is substantiated by plots of mines, pits, and fields on maps showing geologic structures. Examination of space

imagery has revealed many previously unknown structural features and corroborates the old saying, "You can't see the forest for the trees."

The perspective offered by an image taken from an altitude of over 500 miles of an area more than 100 miles on a side has opened a whole new world to mineral exploration geologists. Interpretation of satellite images has produced amazing results. Geologists have used mosaics of these images to enlarge their vision to a continental scale. At a scale of one to a million (one inch equals 16 miles), smaller features are enhanced and large ones are obscured. If the same mosaic is reduced in size, the larger features can be interpreted more easily as the smaller ones are obscured.

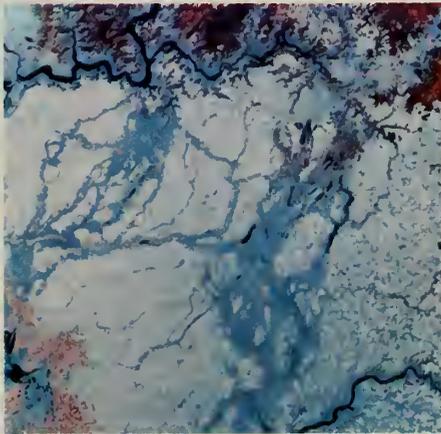
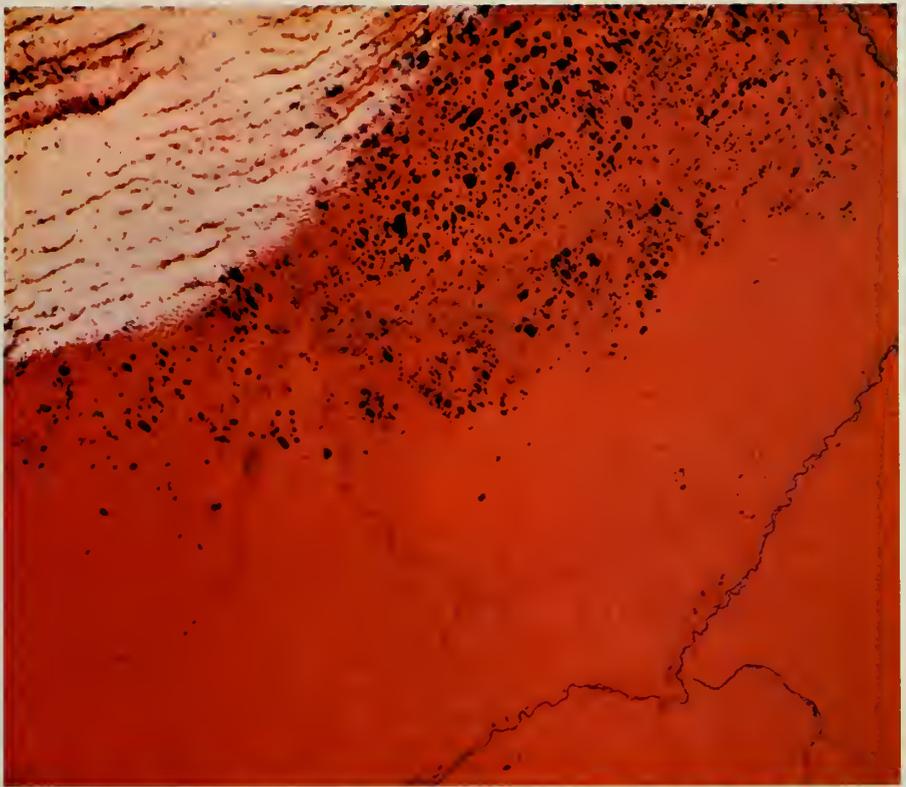
By interpreting these space images the scientists have been able to extend previously known lineaments, recognize new ones, and

more importantly to reassess theories of tectonics which explain the whys and wherefores of mineral deposits. New mineral and mineral fuel exploration target areas have been identified, using the structural information gained from space imagery, in areas of Alaska, the western conterminous U.S., and in the Gulf Coast States.

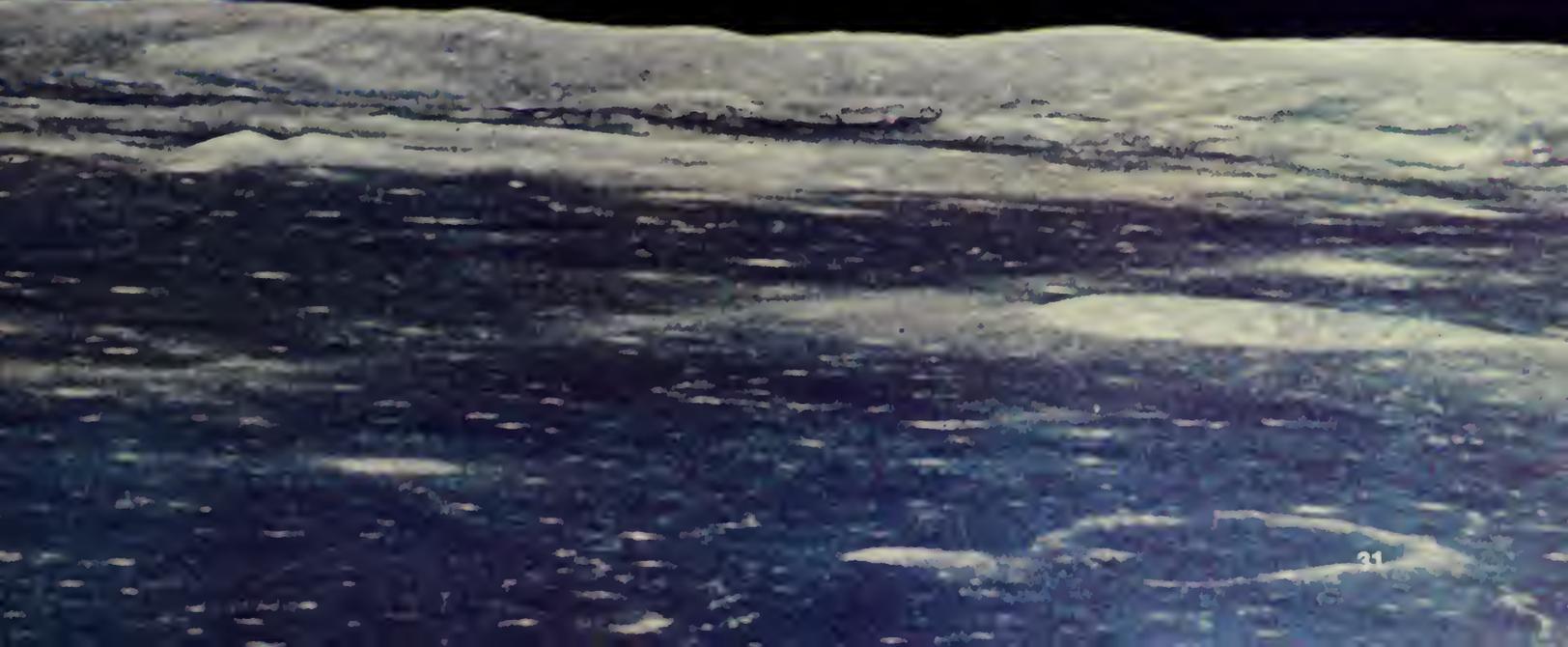
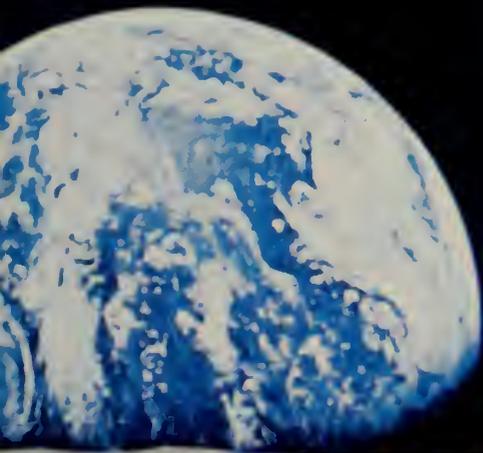
Nevada is the testing ground of U.S. Geological Survey geologists for developing other techniques to indicate potential mineral deposits. It involves using the visible and near infrared parts of the spectrum to discriminate rocks rich in iron on their exposed surfaces. Space imagery from the Earth Resources Technology Satellite (ERTS-1) is acquired as four simultaneous black and white pictures in two separate visible wavelengths and two nonvisible (infrared) wavelengths. The multispectral characteristics of the imagery makes this technique work. Black and white images are produced from pairs of the original black and white images in which the gray tones of the new image are ratios of the gray tones of the two originals. Then "false-color" composite pictures are produced from the new images. The color contrast of potentially mineralized areas resulting from this manipulation is significantly greater than on conventional color photographs. It has made it possible to

correlate particular colors with particular rock types, known mines, and prospects. Extension from the known to the unknown identifies possible mineral target areas.

Whether we choose to explore these targeted areas in detail, and whether we choose to develop those that prove to be actual reserves of commercial quality, are decisions that will be better reached if there is indeed better knowledge. Space technology is offering opportunities to expand the knowledge we require.



Three satellite photographs show (top) Umiat Area of North Slope, Alaska, where alinement of lakes clustered in north-central part of picture may reflect subsurface structures with petroleum potential; (left) channelled scablands of Washington State; and (right) Delaware Bay and surrounding areas of New Jersey, Delaware and Maryland.



New Ideas Improve Work Environment of Nation's Miners

By Rex W. Lauck

The first concern of Interior's new Mining Enforcement and Safety Administration (MESA) is environmental—making sure that the work environment of the Nation's 335,000 miners is safe and healthful—and that miners stay alive and well.

In mid-1973, Secretary Morton established MESA as a separate organization with the health and safety duties and responsibilities formerly carried out by the Bureau of Mines. New ideas instituted by MESA have helped to provide a safer environment for mine workers since the agency was given full-time responsibility for mine health and safety.

One such innovation is that U.S. Air Force cargo planes are now available to transport Federal mine rescue teams and equipment to mine disasters anywhere in the United States. The agreement between MESA and the Air Force not only calls for transporting mine rescue personnel but also for airlifting drilling rigs capable of sinking a man-sized rescue hole as deep as 2,500 feet and seismic in-

struments to locate miners trapped underground. This equipment can "hear" sounds as deep as 1,000 feet underground.

Then MESA put into effect a new mandatory training standard at metal and nonmetal underground mines. The standard requires all underground noncoal miners to take a mine emergency course and training in the use of the self-rescuer, an emergency breathing device designed to protect a miner from asphyxiation from deadly carbon monoxide for an hour to assist his escape from an explosion or mine fire.

The need for industry-wide instruction in use of the self-rescuer was pointed up after the 1972 fire at the Sunshine Mine in Kellogg, Idaho, which took the lives of 91 silver miners. Many victims of that disaster apparently ripped the self-rescuers from their faces when the devices became hot, not realizing that the heat meant they were working properly.

In 1974 MESA, in cooperation with the United Mine Workers of America, began a series of full-day safety training sessions for UMWA Safety Committeemen. Under this program more than 1,000 safety committeemen have received instructions from MESA personnel on such items as mine gases and devices to detect them; use of the

flame safety lamp; ventilation; and use of the anemometer to gage air currents.

MESA also initiated a drive to warn the public of dangers involved in trespassing into abandoned mines and alerted the public to the alarming rise in the numbers of accidents to amateur treasure hunters at abandoned mine sites—such as the asphyxiation of two brothers in a California gold mine that had been abandoned for 65 years. Carbon monoxide rose to lethal levels after the brothers had thrown a burning tire into the mine to rid the mine of bats. But MESA warned that bats are not the only nuisances to be found in abandoned coal or noncoal mines. Many are deadly. They often include rotten timbers and ladders, bad top, loose rock, and perhaps explosives left behind in abandoned mines. Water is dangerous to drink and a potential cause of drowning. Poisonous snakes and harmful insects frequently make their homes in abandoned workings.

Another area where MESA has stepped up its activities to protect both mine and the general environment is inspection of huge coal waste embankments by Federal Coal Mine Inspectors. Now, coal waste embankment evaluations are included in regular inspection reports. Federal mine inspectors have completed special training which

MESA coal mine inspector tests roof bolt for stress and tension.



MESA personnel instruct hard-rock miners on use of self-contained breathing apparatus used in mine rescue.



qualified them to recognize and report on basic unsafe conditions at waste dumps and impoundments. The potential destructive capacity of these slag heaps was dramatically called to public attention by the tragic collapse of a coal mine waste dam at Buffalo Creek, West Virginia, which killed 125 persons in 1972.

MESA is sharply increasing its inspection force for metal and non-metal mines. By June 1975 additions of more inspectors will bring its metal and nonmetal inspection force to 300 inspectors and 156 supervisors and technical support personnel. New inspectors are being trained at MESA's Mine Health and Safety Academy at Beckley, West Virginia, where they receive new and refresher courses in explosives and blasting, wire rope technology, electricity, mine-gas detection, industrial hygiene and inspection procedures.

MESA is also striving to end accidents to operators of rubber-tired front-end loaders, widely used in open pit mining operations. Nationwide seminars on front-end loader safety were held by MESA in 1974. These courses were attended by management and labor, including loader operators and union representatives. They discussed earlier MESA studies which showed that half of the fatalities were occurring at sand and gravel operations and were most frequently caused by backing off roadways or stockpiles, or losing control of a loader when it rolls downhill. MESA studies revealed that up to 65 percent of injuries might not have been fatal had the loader operator received adequate protection in the form of a canopy or a roll bar and seat belts.

MESA and all others interested in coal mine safety, including management and representatives of the workers, are encouraged by an improving trend in fatality and disabling injury rates. MESA's safety innovations and improvements should continue to brighten the safety picture for all miners.



Typical ancient lake beds in West may lead to surprise discovery.

Mineral Serendipity Brings Important Resource Bonus

By Donald A. Brobst

Keen observation, scientific curiosity and geologic knowledge commonly lead to mineral serendipity—the faculty for making desirable discoveries of useful minerals while looking primarily for another mineral.

Mineral serendipity has been a factor in the development of the mining industry in the United States. In the rush for gold and silver in the West during the last century, many mining districts were found. Some are still active but are known less for their byproduct gold and silver than for their great production of other metals, such as copper, lead, and zinc.

In modern times, geologic study of mineral deposits and development of new technology permit deliberate search for deposits that will yield more than one commercial mineral product. Even so, fundamental geologic research still leads

to surprise discoveries of minerals in new geographic areas of geologic environments.

The Mountain Pass area of San Bernardino County, California, has been touched by three waves of prospecting and mineral production during the past 110 years. The first wave in 1860-85 yielded silver and base metals. The second wave in the 1930's yielded gold. The third wave began in 1949 with a search for radioactive materials that resulted in the discovery and development of one of the world's great commercial concentrations of rare earth minerals and barite.

During the past decade, scientists have made detailed study of sedimentary and volcanic deposits in ancient alkaline lakes of the Western States.

At the lake margins, most of the volcanic beds contain unaltered volcanic glass. Toward the middle of the lakes, the rocks are rich in zeolite minerals, and near the centers of the lakes, nearly pure beds of potash feldspar are found. Significant tonnages of this mineral with potential commercial value may also occur in the Barstow Formation in southern California. Near

Rome, Oregon, fluorspar occurs in minute grains of potential commercial value in volcanic and sedimentary materials deposited in alkaline lakes that existed millions of years ago.

The once great fresh-to-alkaline lakes that existed in Colorado, Utah, and Wyoming about 40 million years ago contain abundant deposits of oil shale potentially valuable for future development. Detailed study of oil shales has led to the discovery and development of immense deposits of trona in Wyoming. Similar study of oil shale in Colorado indicated that great deposits of nahcolite (sodium bicarbonate) and dawsonite (a hydrous sodium aluminum carbonate) occur there. Dawsonite has been recognized as a potential source of aluminum that might be a byproduct of shale oil production. Dawsonite and nahcolite are potential decontaminants in the fight against air and water pollution.

In 1967, a search for indications of gold deposits in the Toquima Range of Nye County, Nevada, brought U.S. Geological Survey geologists to the mouth of East Northumberland Canyon where bedded deposits of black barite were found. Commercial mining of these deposits began in 1973. Few people are aware that this heavy mineral, the sulfate of barium, has been vital to the drilling operations of the petroleum industry since 1926. The barite added to the fluid used in the rotary drilling of wells performs several functions that reduce the risk of bringing in a "gusher," and allow the tapping of deeply buried reservoirs of oil and gas.

Oil shale cliffs hold other minerals.



Secretary of the Interior Morton and Leslie Grainger, Member of Great Britain's National Coal Board, at the signing of joint United States-Britain international coal research exchange agreement.

International Cooperation Aids Resources

By Barbara M. Burns

International cooperation offers significant dimensions in developing energy resources and protecting the world's natural heritage.

The Department of the Interior is the lead Federal agency for the United States in carrying out numerous cooperative international energy and natural resource agreements.

"Our individual collective energy options are decreasing," Secretary Morton said at the 1973 International Coal Research Conference. "We simply can no longer afford to rely on national solutions to international energy problems."

In June 1974 Secretary Morton signed an agreement with the National Coal Board of London to exchange the latest achievements in coal technology, particularly coal conversion systems that may lead to cleaner fuels.

A cooperative program with Japan on geothermal energy is underway. Interior is a member of the U.S. team involved in a multina-

tional geothermal project conducted under the auspices of NATO's Committee on Challenges of Modern Society.

Department specialists are working with Soviet counterparts in deep coal mining and magnetohydrodynamics (MHD). Interior has been the prime mover behind U.S. participation in the Sixth International Conference on MHD Electrical Power Generation, which will be held in April 1975.

In support of its widespread interest in and responsibility for energy development, the Department contributed financially to the support of the Ninth World Energy Conference held in Detroit in September 1974.

Interior and Soviet experts are tackling water resources problems and working together to resolve technical and environmental problems in wildlife conservation, permafrost, preservation of reserved areas, and pollution of the marine environment from offshore oil operations.

Following ratification of the World Heritage Convention in December 1973, Secretary Morton expressed hope for establishment of a system to collectively protect mankind's cultural and natural heritage of outstanding universal value. The U.S.

was the first nation to ratify the Convention approved by 78 countries at the 1972 United Nations Educational, Scientific and Cultural Organization's General Conference. Under the Convention, and the Endangered Species Act of 1973, Interior is increasing its efforts to protect endangered species throughout the world and to control international trade in such species.

Cooperative programs are in operation with Poland and Yugoslavia in mining, the earth sciences, and desalination, and with Spain on solid waste management, marine geology, and water resources.

Several international agreements recently concluded are expected to result in other programs involving the Department's expertise. An agreement signed June 8, 1974, by the U.S. and Saudi Arabia will build on work already being performed in that country by Departmental specialists in water resources, earth sciences and minerals.

A scientific research program that has become a model for cooperation on environmental problems in the Arctic was the product of an Interior-sponsored First International Scientific Meeting on the Polar Bear held in 1965 in Fairbanks, Alaska. Research efforts undertaken as a result of that program led to the signing in October 1973 of an agreement among the countries with Arctic interests to take measures to protect and conserve the polar bear, which the U.S. believes may be endangered. The agreement is under consideration for ratification by the U.S., the Soviet Union, Canada, Norway, and Denmark. It provides for international cooperative research management, protection of Arctic ecosystems, special protection from certain types of hunting, and better control of traffic in hides.

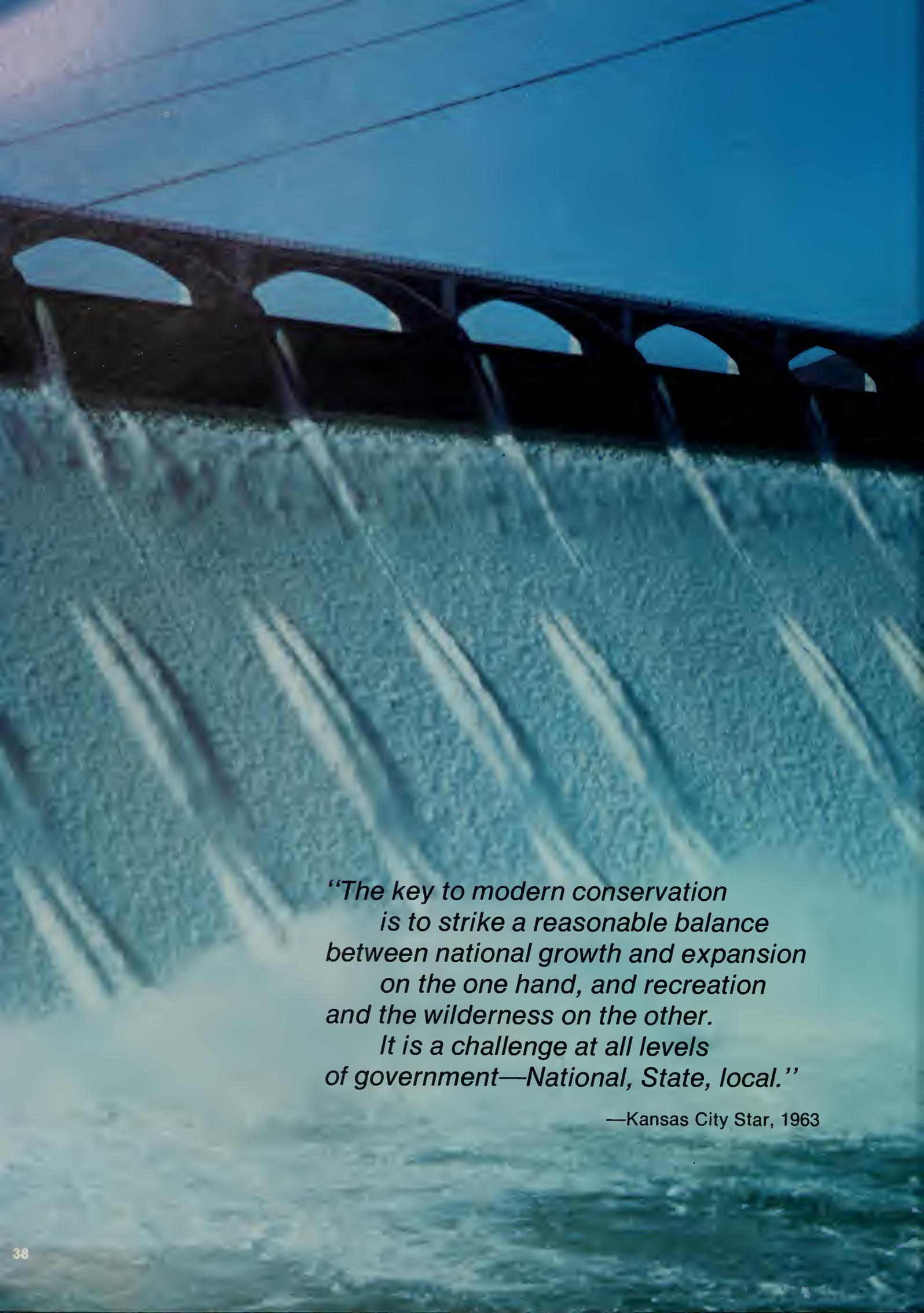
Steller sea lions on Chiswell Island, Kenai Fjords, Alaska, are part of arctic wildlife scene that must have protection to thrive.





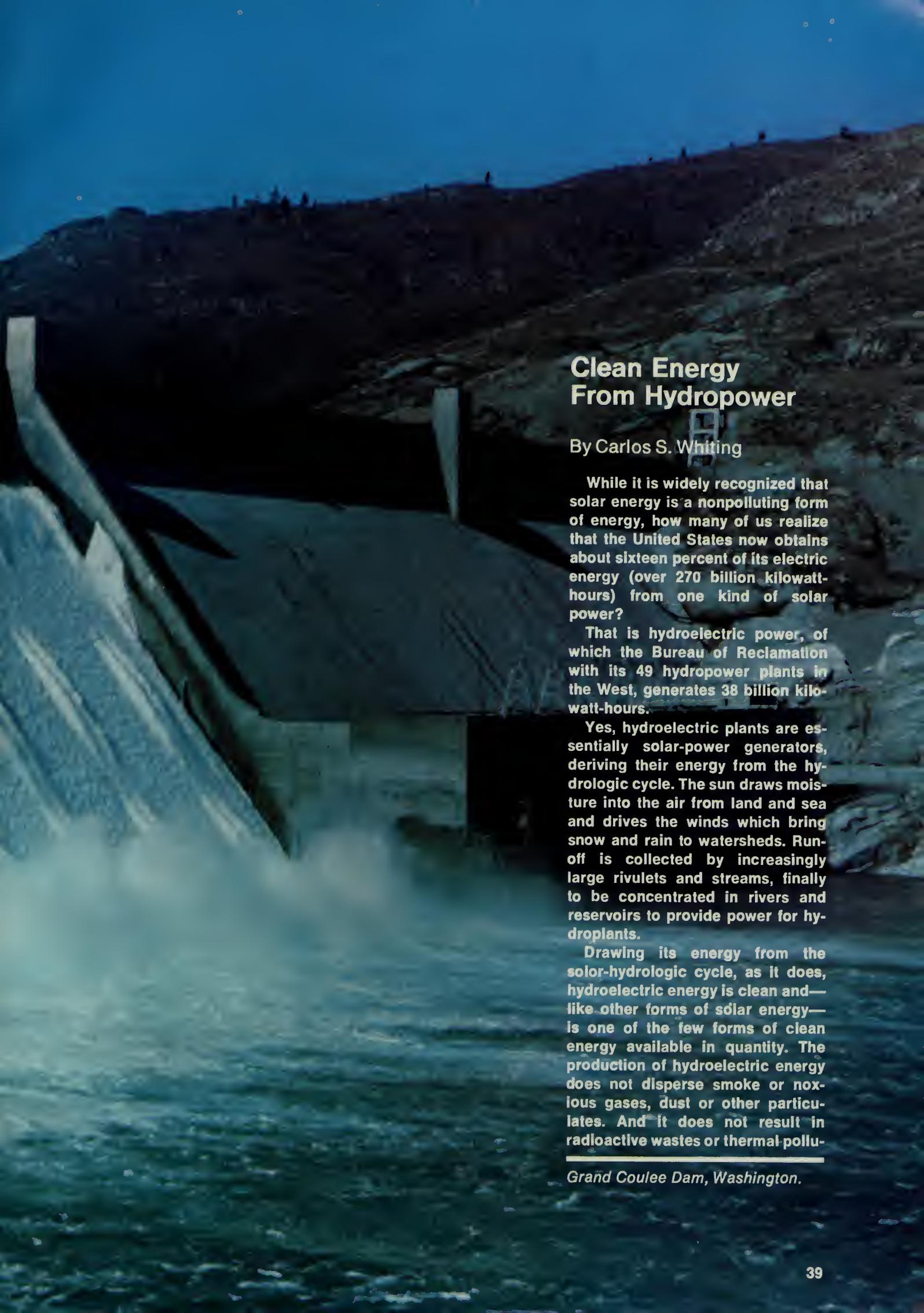
A dramatic sunset or sunrise over an industrial landscape. The sky is filled with vibrant orange and red hues, with a large plume of dark smoke rising from a chimney on the right. The foreground is dark and silhouetted, showing the outlines of industrial structures and a person standing in the distance. The overall mood is somber and evocative, suggesting the impact of industrial activity on the environment.

ENERGY FOR THE FUTURE



*“The key to modern conservation
is to strike a reasonable balance
between national growth and expansion
on the one hand, and recreation
and the wilderness on the other.
It is a challenge at all levels
of government—National, State, local.”*

—Kansas City Star, 1963



Clean Energy From Hydropower

By Carlos S. Whiting

While it is widely recognized that solar energy is a nonpolluting form of energy, how many of us realize that the United States now obtains about sixteen percent of its electric energy (over 270 billion kilowatt-hours) from one kind of solar power?

That is hydroelectric power, of which the Bureau of Reclamation with its 49 hydropower plants in the West, generates 38 billion kilowatt-hours.

Yes, hydroelectric plants are essentially solar-power generators, deriving their energy from the hydrologic cycle. The sun draws moisture into the air from land and sea and drives the winds which bring snow and rain to watersheds. Run-off is collected by increasingly large rivulets and streams, finally to be concentrated in rivers and reservoirs to provide power for hydroplants.

Drawing its energy from the solar-hydrologic cycle, as it does, hydroelectric energy is clean and—like other forms of solar energy—is one of the few forms of clean energy available in quantity. The production of hydroelectric energy does not disperse smoke or noxious gases, dust or other particulates. And it does not result in radioactive wastes or thermal pollu-

Grand Coulee Dam, Washington.

tion. Some or all of these latter pollutants are part and parcel, to some degree, of every fossil-fueled and nuclear-powered electric plant in the world.

Unlike thermal generation, however, hydropower has the advantage of being available on very short notice with little loss of efficiency. Therefore, in an integrated power system, the much larger thermal generators can be operated at their most efficient level around-the-clock, while the hydroelectric generators meet the additional requirements of the heavy use or peak periods. This procedure is called "peaking with hydro."

If hydroelectric energy produced at Reclamation's powerplants were



Inside a generator room at Grand Coulee Dam.

produced from fossil fuel resources, it would require annually the equivalent of either 75 million barrels of oil or 18 million tons of coal.

Put in another context, the energy produced by Reclamation's plants would meet the residential requirements for one year of New York, Washington, D.C., Dallas, Chicago, and San Francisco.

In the West, where the Bureau of Reclamation operates, the present total capacity of the Bureau's installed plants is 7,700,892 kilowatts. In addition, the Bureau markets the power from Corps of Engineers plants and the International Boundary and Water Commission plants with a combined capacity of 2,079,500 kilowatts.

The Bureau's biggest generating complex is Grand Coulee on the

Columbia River in Washington State. At Grand Coulee, generators with a capacity of 2,295,000 kilowatts are installed in the left and right powerplants. There are 100,000 kilowatts of pump-generating capacity in the pumping-generating plant. And 3,900,000 kilowatts are being installed in the new Third Powerplant. Ultimately, with additional installation, Grand Coulee will be the world's largest hydroelectric power complex with a total of about 10 million kilowatts of installed capacity.

The big Yellowtail powerplant on the upper reaches of the Missouri River with 250,000 kilowatts, and Hungry Horse on the Snake River with 285,000 kilowatts, are two typical Reclamation hydroelectric features.

On the Lower Colorado River the biggest and best-known hydroelectric plants are Glen Canyon with 950,000 kilowatts, and Hoover with 1,344,800 kilowatts.

In California, the well-known Shasta Powerplant has a capacity of 422,310 kilowatts. It is a part of the Central Valley project which has 9 powerplants with a combined capacity of 1.3 million kilowatts. The CVP provides electric energy for many uses to customers all over northern California.

The Bureau of Reclamation has identified 43 potential hydroelectric developments for future appraisal and feasibility level investigations. As possible new projects, or additions to existing projects, these sites reflect the potential of 46 billion kilowatts of additional electric energy.

The cleanliness and potential of hydroelectric energy cannot be told solely in terms of powerplants and generating capacity, however. Better utilization of existing water resources and the addition of new water will make the present and any future plants more efficient.

Through improvements in water delivery systems and in utilization of irrigation water, for example,



Drip irrigation nourishes young almond tree.

considerable pumping energy can be saved for use in areas of great need. Trickle irrigation—stretching available irrigation water supplies by dripping water precisely where needed—is but one example. Even a five percent reduction in water pumped on Reclamation projects, a reasonable saving, would be equal to 240,000 barrels of oil if that energy had to be made up from thermal-electric plants.

More efficient use of existing hydroplants will also result from increasing precipitation in mountain watersheds. Wintertime cloud seeding increases the snowpack, for subsequent runoff to fill storage reservoirs, and summertime rain-making reduces the need for irrigation water releases. With integrated data gathering and computerized release of water through downstream hydroelectric plants, the multiple needs of water users are met with the greatest net generation of electric energy.

In addition to improving efficiencies and economies in hydroelectric generation, Reclamation is stepping up engineering research. This will include research on improved automation and systems

Cloud-seeding generator used at Mt. Harris weather station in Colorado.



control—including rapid start-up and loading of hydromachines—and developing better turbine-generators and pump-turbines, which will allow greater flexibility when “peaking with hydro.”

New questions are being asked concerning the possibility of developing lowhead turbines to take advantage of many additional potential sites for hydroelectric generation without major structures and with a minimum of environmental disturbance.

Although the Bureau of Reclamation is an engineering and resource development agency with a specialized competency in hydroelectric energy, it has broad research and development capabilities.

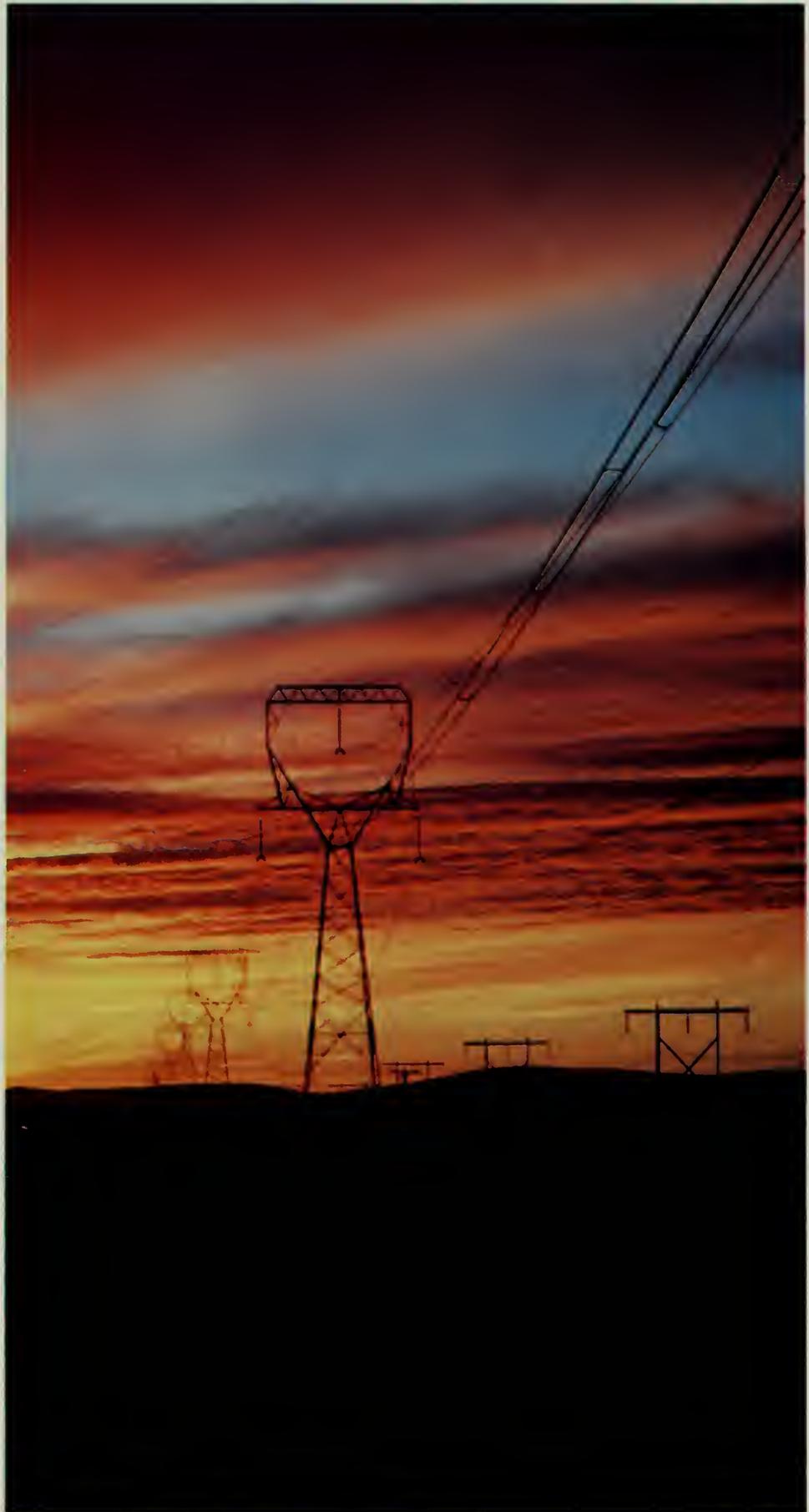
While not presently linked to energy production, the Bureau’s geothermal research (in the production of fresh water from geothermal brines) has ultimate potential in technical know-how for electric generation.

Similarly, the development of wind power and solar-steam power for electric energy production can be linked to Reclamation’s hydroelectric potential.

These “exotic” sources of energy may be developed for pumped storage hydroplants, needed for meeting peak energy needs in a conventional system. Pumped storage and other hydropower are the only economically feasible means of storing commercial quantities of energy for use when needed.

Pumped storage is water which is pumped to a storage pool high in the hills at a time when customer demand for energy is low (as during the middle of the night) and then allowed to fall back through combination pump-generators at breakfast or dinner time when customer demand is high and a heavy load is placed on the system.

There are many ways to make more efficient and effective use of hydroelectric energy, and one of the Bureau of Reclamation’s desires is to find them.





Geothermal— The Resource From Within

By Wayne A. Fernelius
and Kenneth E. Mathias

Geothermal deposits are a potential source of energy for many uses. Heat energy stored in subsurface brines deep below the earth's surface may be used not only to generate electricity, but also to desalt water and recover mineral byproducts. Through proper planning, this resource may be economically developed for all of those purposes while still protecting environmental quality.

The Bureau of Reclamation in 1974 is exploring geothermal resources in the Imperial Valley of southern California. A research and development program is underway in the East Mesa area of Imperial Valley to investigate the feasibility of desalting the huge quantity of mineralized geothermal fluids potentially available for possible use in the water-short Pacific Southwest.



Four production test wells already have been drilled on a promising thermal anomaly about 10 miles east of Holtville, Calif. The first was drilled to a depth of 8,000 feet. The other wells, located by information gathered from drilling and operating the first well and from surface geophysical work, were drilled to the 6,000-foot level. All have proved capable of producing either steam and liquid or all liquid

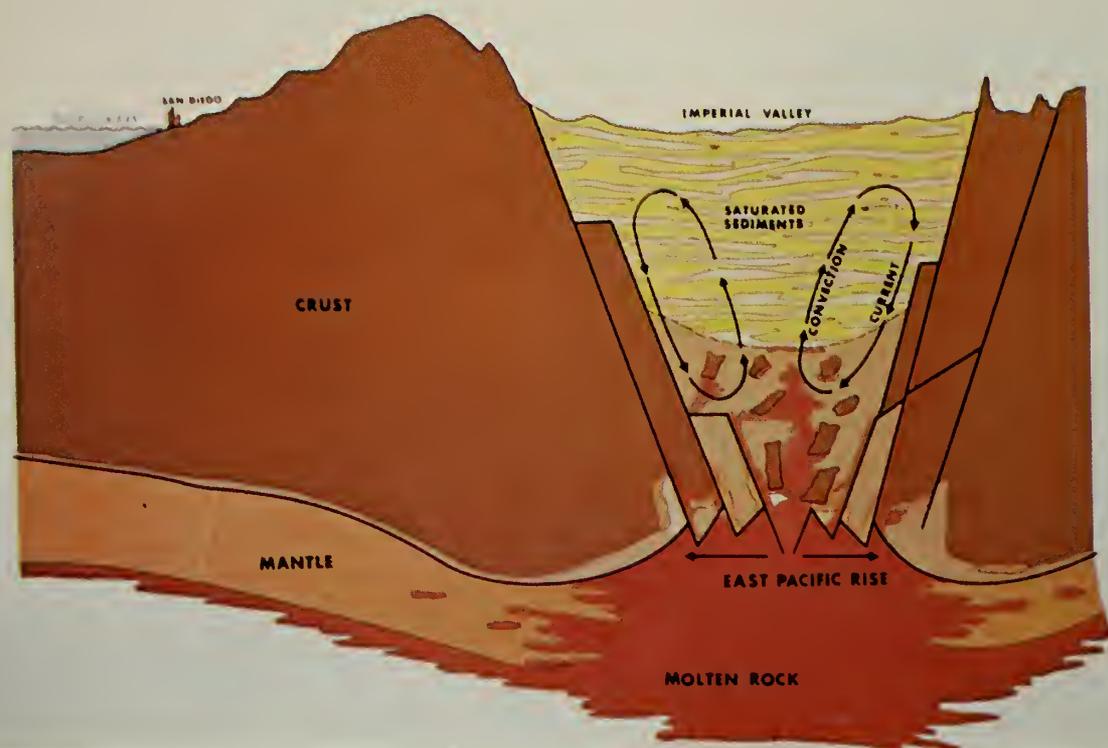
at the surface, depending upon operating conditions. The bottom hole temperature measured at the deep well is 400°F. The bottom hole temperatures measured in the shallower wells range from 350°F to 370°F. Two of the wells will provide heat energy and brines for the desalting test units. The other two will provide information about the dynamics of a geothermal anomaly. In addition, a well was drilled to be

used for reinjection of waste brines from the desalting units. A number of shallow test holes 300 to 1,000 feet deep have been drilled to obtain heat flow data.

Two desalting units, a multistage flash unit and a vertical tube evaporator unit, have been erected in

Geothermal deposits are found widely in the West, but some are not for development. Above, a scene in Yellowstone National Park.

GEOTHERMAL RESOURCE INVESTIGATIONS - IMPERIAL VALLEY, CALIFORNIA
GENERALIZED SECTION THROUGH THE SALTON TROUGH



the East Mesa test site in cooperation with the Office of Saline Water. The units, operating on the principle of condensing steam to obtain distilled water, have been operated on shakedown runs for several days at a time producing a substantial quantity of quality water. After desalting, the dissolved solids total less than 30 parts per million (p/m). Each unit is designed to produce up to 50,000 gallons per day of product water.

Consideration of environmental parameters associated with geothermal development is a major part of the Bureau's studies. Thus far, however, environmental problems have been relatively minor in the Imperial Valley. Noise from drilling and testing has not been a problem in the Bureau's operations. Release of noxious gases, mainly hydrogen sulfide, from wells and production plants has been found to be negligible in the East Mesa areas. Land subsidence and earthquake activ-

ity are being investigated and evaluated by monitoring surveys. Monitoring programs for microearthquake seismic events and for subsidence, by tiltmeter networks and level networks, are underway. With the withdrawal of large quantities of fluids, land subsidence could be a major problem. However, it is anticipated that the injection of makeup water from either imported sources or residual brines from plant operations or both would prevent subsidence.

Reclamation's geothermal research and development stage will culminate in construction of larger desalting plants including a prototype plant of 2 to 5 million gallons per day capacity. Later program stages will evaluate the feasibility of producing large quantities of quality water along with the generation of electric energy required for plant operation. Investigation of mineral recovery and uses of pure water will be included in the pro-

gram. A successful multipurpose development will result in lower cost products than a single-purpose development.

Reclamation has a unique test facility in Imperial Valley which is being utilized by the scientific community for testing and research. Several proposals have been made to install test units at the site. Such units include: heat exchangers, downhole pumps, different types of desalting plants, scale test units, and various types of electric generators.

Delivery points for product water are being analyzed to determine the most effective location. Possible points of delivery would be the nearby canal systems, the Colorado River at Imperial Dam or as far upstream as Lake Mead for maximum storage and regulation.

As water requirements increase along the Colorado River system, the need for augmentation becomes more critical. The Colorado River



is the life blood of the Pacific Southwest and is the most regulated and utilized river in the United States. The Colorado River Compact allocates more water per year for use by the seven basin states than the runoff records of recent decades indicate are available.

The U.S. also has an obligation to deliver 1.5 million acre-feet of water annually to Mexico. Studies indicate that unless the riverflow is augmented, the water supply cannot meet future requirements. The available surface water supplies in the Upper and Lower Colorado River Basins have been taxed by expanding agricultural demands and by a generally expanding population which is using water at an increasing per capita rate.

To add to the problems of the area, groundwater, an important source of water supply in the area, is being depleted at a rapid rate in some locations. The decline resulting from the depletion of the

groundwater resource has caused some lands to go out of production, significant increases in pumping costs, and a decline in water quality.

Compounding the quantity problem are water quality problems. The Colorado River Basin is characterized by highly saline soils and many saline springs which add significant quantities of salt to the river. The salinity of the river is increasing and, without a major water quality improvement program, projections indicate that the Colorado River at Imperial Dam will increase from about 830 p/m at present to more than 1,150 p/m by the turn of the century. The Colorado River would then become unsuitable for many of its present uses.

The augmentation of the river with virtually pure water would therefore do much to increase both the quality and quantity of water available.

Desalted geothermal brines might

Artist's concept (p. 44) of the geologic structure and source of geothermal heat in Imperial Valley, California; above, left, steam and liquid, 230 degrees F, gush from a geothermal well; and above, right, is a multistage flash distillation unit.

be one source of water that could be used for this augmentation.

In view of the present energy shortages and possible future water shortages, it is becoming increasingly important that man take the necessary steps to begin releasing the energy and water captured for centuries beneath the surface of the earth.



Comeback For Coal

By Paul R. Jordan

Eclipsed a generation ago by oil and gas as a leading source of energy, coal is emerging as a prime target for technological answers to energy shortages in the United States.

The turnabout in the 1970's is rooted deeply in the age-old concept of supply and demand. While premium fuels have fallen on troubled times for a variety of socio-economic reasons, coal lies in bountiful supply within American boundaries.

The strategy is logical enough:

with the expansion of methods for using coal as a clean-burning fuel, the U.S. could release quantities of oil and gas for more specialized uses; thus, there would be less dependence on foreign imports as the Nation bridges the energy gap between now and the year 2000.

Pros and cons were brought forth by President Nixon's energy messages and by the continuing debates in congressional, governmental, industrial, and environmental circles.

Stressing the need for "Project Independence," the President set a goal of U.S. energy self-sufficiency by 1980 and established funding



levels for a \$10-billion program. Up to half that amount would be available for the Interior Department through fiscal year 1979. For the Office of Coal Research (OCR) alone, funding escalated from \$123 million in FY 1974 to a request of \$283.4 million for FY 1975.

Coal's enlarged role will require greatly increased production—perhaps as much as two billion tons annually by 1985—or more than three times the 600 million tons produced in 1973.

Calling for a "National Coal Strategy" to triple productivity, Secretary of the Interior Rogers C. B. Morton said:

"This is a tall order, and two things will have to take place. First, we will need to make a market for this much coal, which is mainly a function of its environmental acceptability. Second, we will have to find ways of producing enough coal at acceptable social and economic cost, to satisfy the market we have created. The requirement here is for a coal industry capable of delivering the coal that will be needed."

The Nation's most abundant fossil fuel stood tall in the energy spec-

trum until consumers turned to cheaper natural gas and petroleum products after World War II. In

Crushed coal spews from conveyor at Dave Johnson mine-mouth generating plant in Wyoming.

1947, for example, coal production reached a record high of 630 million tons. Unable to meet onrushing competition, production dropped to 391 million tons in 1954 and then leveled off to around 500 million tons annually.

The shifting nature of coal's markets is told most dramatically in its usage by railroads. From a high of 130 million tons in 1943, U.S. railroads used only 2 million tons in 1960. Even so, the coal flame continued to flicker with increased usage by the electric power industry—from almost 174 million tons in 1960 to more than twice that in 1974.

Besides political implications which surfaced during the Arab oil embargo in 1973 and early 1974, coal's rebirth is tied inextricably to the knowledge that some 3 trillion tons of coal exist in 30 of the 50 states. That represents about 90 per cent of the proven reserves of all developed fuels; yet, coal supplies only about 18 per cent of the Nation's total energy requirements.

Modern technology could eventually recover about half of the total coal reserves and protect the environment as well.

Not much likelihood exists for running out of coal soon. At the 1973 rate of consumption, Interior scientists believe, proven coal reserves would not be exhausted for at least 600 years.

The big problem with coal is that it burns dirty, is expensive to transport, and—due largely to stripmining—is considered an anathema by strict environmentalists. Federal regulations limit emissions of sulfur dioxide to 1.2 pounds per million Btu of fuel burned. For bituminous coal, this is less than 1 per cent sulfur and for lignite less than one-half per cent.

How, then, can this vast energy resource be used to its best advantage without polluting the air? What choices lie ahead?

Some of the answers are interwoven with the characteristics of



Tipple at Decker mine in Montana.

fossil fuels and the technology that holds the key to clean conversion processes.

Coal is similar to petroleum. Both can be burned to produce heat or generate power, but the similarity does not end there. They have practically the same chemical ingredients with different ratios of hydrogen to carbon and, just as petroleum must be separated into more useful products such as gasoline, kerosene, lubricants, and the like, coal can be converted to clean synthetic gas, low-sulfur liquids and solids, and electricity.

On the technological side, OCR is operating pilot plants to develop economically feasible processes for producing pipeline quality gas from coal and synthetic crude oil. Gasification plants being co-funded by the American Gas Association are located in Rapid City, South Dakota, and Chicago, Illinois; a third high-Btu pilot plant is under construction at Homer City, Pennsylvania. Pilot plants for low-Btu gas, which would be used for power generation, are in the design stage.

For development of liquefaction processes, pilot plants include a newly-built facility near Tacoma, Washington, and a plant that has been operating for three years at Princeton, New Jersey. A third coal-to-liquid plant, shut down since 1970, is being reactivated at Cresap, West Virginia.

All of these pilot plants are the forerunners of large demonstration plants which, in turn, will lead to industry-built commercial plants in the 1980's. (This part of the OCR program is explained in the *Last Plateau*, page 49.)

OCR is also devising ways to burn coal more cleanly and efficiently through the use of fluidized bed boilers for direct combustion. In addition, research is going forward on combined power cycles, including magnetohydrodynamic (MHD) power generation—a sort of turbine in which all the moving parts are gases.

The exact date of the first use of coal is not known, but there is evidence that 3,000 to 4,000 years ago during the Bronze Age, the people of Glamorganshire, Wales, used coal for funeral pyres to burn their dead. The Chinese probably used coal about 1,100 years before the Christian Era. Coal is mentioned several times in the Bible.

The Industrial Revolution, dating from the mid-1700's in Great Britain, was largely dependent on coal as the chief source of power to drive steam engines. Coal was discovered in North America in 1679. Father Louis Hennepin, a member of an early French exploring party, observed the black mineral along the Illinois River at a point about 80 miles southwest of the present city of Chicago.

With growing industrialization, especially after 1850, coal was increasingly used in the United States. The growth of railroads gave the coal industry one of its largest customers, and also stimulated the iron and steel industry. In the 1890's, the development of steam-driven electric generators sparked the growth of the electric power industry, the modern coal industry's largest consumer.

For coal in the 1970's, it is a new beginning.

The Last Plateau

By Paul R. Jordan

Technology for producing clean energy from coal is nearing the last plateau of testing before being applied commercially to produce synthetic fuels in the early 1980's.

Pilot plant performances thus far have provided engineering knowledge to advance conversion technology to the demonstration stage. The first of these large plants is expected to establish a reliable source of low-sulfur boiler fuels to generate electric power for consumers in highly populated centers.

As a rule of thumb, a demonstration plant will produce daily about 80 million cubic feet of pipeline quality gas or 30,000 barrels of synthetic crude oil. Such a plant will cost approximately \$300 million, with at least half that amount coming from non-Federal sponsors.

In early 1974, the Office of Coal Research (OCR), lead agency for coal conversion, began the competitive procedure for selecting contractors to design, construct and operate a demonstration plant capable of converting high-sulfur coal into a clean boiler fuel.

Qualified groups were asked to submit proposals for specific designs related to boiler fuel technology for the production of liquids or solids, or both. The next step was to evaluate the proposals and award contracts.

Here are the criteria for construction of demonstration plants, which would be about one-third as large as commercial plants:

- Fifty per cent non-Federal funding as a minimum. On the part of the industry, this amount would range from \$50 million to as much as \$150 million—or, a total investment of \$300 million over a five or six-year period.

- The chosen process must be technically sound as well as environmentally satisfactory. That

means the plant must deliver the products generally as indicated, with all emissions into the atmosphere meeting current standards and a minimum of waste being discharged into streams.

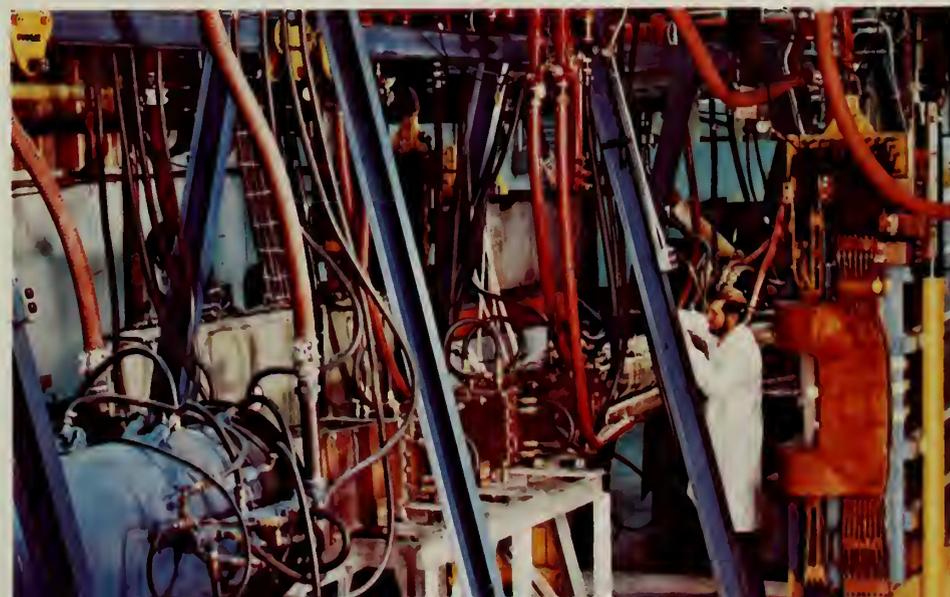
- The processing plant must be economically sound—meaning that a scaled-up commercial plant must compete, dollar-wise, with conventional methods of producing oil, gas, or electricity.

A presidential study group was looking into the funding questions to determine industry's capacity to meet matching fund requirements. Various mechanisms were being studied in an effort to solve the cost sharing problem—low interest, rapid tax write-offs, support prices for the product and plant, or a combination of these elements, as well as changing the nature of the sharing.

If all goes well, sufficient operating data should be available to energy-producing industries in the late 1970's so that they can then make long-term commitments to produce large quantities of synthetic fuels from coal.

Meanwhile, acting on their own, some industries requested Federal funds to match non-Federal money earmarked for demonstration/commercial plants planned at locations of their choosing. In these cases, industry participants would retain the predominant voice in locating a plant or plants to serve particular purposes.

Technician connects electrode leads to MHD generator channel downstream from burner.



According to economic projections, commercial plants of the future would produce synthetic gases for costs ranging from 90 cents per thousand cubic feet (MCF) for low Btu gas to \$1.35 per MCF for high Btu gas. Liquid products would range from \$6 to as much as \$11 per barrel.

Prior to advertising for proposals, OCR issued reports that described a preliminary process design for a demonstration plant to produce clean boiler fuels from coal, as well as cost estimates for building and operating it.

The prototype plant was described as having a capacity to process 10,000 tons of coal per day and produce approximately 25,000 barrels of liquid products. Primary products would consist of two grades of clean boiler fuels, with secondary products being a high-grade naphtha and sulfur. The liquid boiler fuels would have an energy content of about 145 billion Btu's per day. This amount could generate 620 megawatts of electrical energy—enough to supply some 100,000 households.

Such a facility would occupy about 350 acres, but the reports recommend a site of at least 600-plus acres.

All energy to operate the plant would come from by-products produced from coal fed into the process units. As an alternate, the plant could market a high quality gas along with the liquid products.



Water For Strip Mining

By Phil Gibbs

Within the Fort Union-Powder River Basin Coal Region, which embraces large segments of North Dakota, South Dakota, Wyoming, and Montana, lie billions of tons of lignite and sub-bituminous coal.

Because of its low sulfur content, the thick beds in which it is found and the ease of mining it from the surface, this coal represents an extremely valuable resource in today's quest for new sources of energy.

One of the major problems connected with the development of this resource is the need for sufficient water in the area of the coal deposits. Water is needed in lesser or greater amounts depending upon the methods used to bring the coal—or the power generated by the coal—from rural mines to metropolitan areas where the energy is needed.

Mines which export coal by unit trains do not require water for processing. Such mining activities need a domestic supply for employees, but water for drinking, showering, road construction, dust control, and sewerage for less than

100 persons adds up to a minor quantity. Small amounts of water can usually be obtained from local sources for export mines, and frequently the mining cuts will intercept enough groundwater to serve the facility.

But another method of exporting

coal is by slurry pipeline. This method requires that water and coal be mixed to a consistency which can be moved through a pipeline, sometimes over great distances. These lines can be up to 38 inches in diameter, buried, quiet, and efficient. It is estimated that



30,000 acre-feet of water would permit the export of 50 million tons of coal by slurry method.

In some cases, rather than exporting coal, conversion at the mine mouth is also practical. Electric energy produced on site can be moved to load centers over transmission

networks. In the Fort Union-Powder River Basin Coal Region it is estimated that water requirements will be about 19,000 acre-feet per year for each 1,000-megawatt power station. This quantity of water would permit wet cooling and would be the maximum amount of water required for all purposes. Water demand could be reduced by using dry cooling towers or a combination of wet and dry tower cooling. In each instance, economics will probably govern the selection of cooling process—the annual cost of delivered water compared to savings in capital costs of cooling towers.

The supply of natural gas is diminishing. The potential for replacing it by synthetic pipeline gas made from coal appears to be a major use of the coal resource. There are several processes by which coal can be converted into synthetic gas, but the process which will result in the most economic procedure to methanize the product and raise its Btu count will be favored for selection and plant design.

The range of water requirements for gasification of coal is wide. In addition to the gasification process, the cooling method, elevation, air temperature, and properties of the coal influence water needs. It is not

possible to determine exactly the water requirements at a site, but two estimates seem to be widely accepted as maximum and minimum requirements. An allowance of 30,000 acre-feet annually for a standard size plant (250 million cubic feet of gas per day) should be adequate to completely serve the site and permit quality control of effluent waters so that the residual flows can be used for all other water purposes. An allowance as low as 10,000 acre-feet annually would require complete recycling and treatment with nearly a zero discharge of effluent.

If only 10,000 acre-feet of water is available at a gasification site, solids disposal and evaporation ponds to prevent water return become problems. Water use would be stringent and recycling would become costly. With 30,000 acre-feet of water available, the amount consumed would be little different, but enough water would be available for other purposes after mixing with the effluent to control overall water quality. Water to assist in any difficult reclaiming of mined areas, and water for recreation, agriculture and livestock would be available.

Water in large quantities is only available at certain locations and one alternative would be to convey

it to coal conversion sites through large-diameter aqueducts. Water in great amounts is already available at Fort Peck Reservoir in Montana and Lake Sakakawea behind Garrison Dam in North Dakota. Both of these storage facilities are on the Missouri River. Bighorn Lake behind Yellowtail Dam, located on the Bighorn River, the largest tributary of the Yellowstone, can provide large amounts of water for industry. These three reservoirs can probably provide all the water needed for coal conversion, but more than 600 miles of aqueducts would be required to move the water to major coal deposits.

For a smaller scope of development, water could be made avail-



Reclaimed land sets good example. Above, section of Big Horn Coal Company strip mine in Montana.

able by developing new reservoirs on tributary rivers and constructing shorter pipelines to the coal deposits. Streams like Powder River, Tongue River, Little Missouri, Knife, and Cannonball Rivers could each produce enough water to serve one or more generating stations or gasification plants.

Small scale development could best be served from deep groundwater sources within a few miles of the site. Costs could be as low as \$50 to \$60 per acre-foot. Reservoir construction and pipelines to the site from 60 miles or more away would cost \$60 to \$80 per acre-foot delivered. These local sources would be practical and least expensive, but development would be limited to only a half-dozen plants and to those locations where water was available.

Accelerating the Pace of Offshore Leasing

By Paul C. Herndon

On January 23, 1974, President Nixon delivered an energy message to Congress which directed the Secretary of the Interior to offer 10 million acres of the Nation's Outer Continental Shelf (OCS) annually for oil and gas leasing starting in 1975. At the same time he directed the Department to provide adequate safeguards for the marine and coastal environments as a part of its leasing program.

Those who sat in gas lines during the winter of 1973-74 need not be reminded that the United States must increase its domestic sources of oil and gas. Shortages graphically demonstrated the need for an ample supply of petroleum products. They also demonstrated how vulnerable is a nation that must depend on foreign sources for substantial amounts of its energy supplies.

Oil and gas provide 78 percent of the Nation's energy needs. Seventeen percent comes from coal and other sources provide only 5 percent. We will have to rely on petroleum products as the major source of energy for the next 20 to 30 years. This will put us into the 21st Century in an era when exotic forms of energy can be expected to come into use. The short-range energy demand provides ample reason for accelerated OCS leasing.

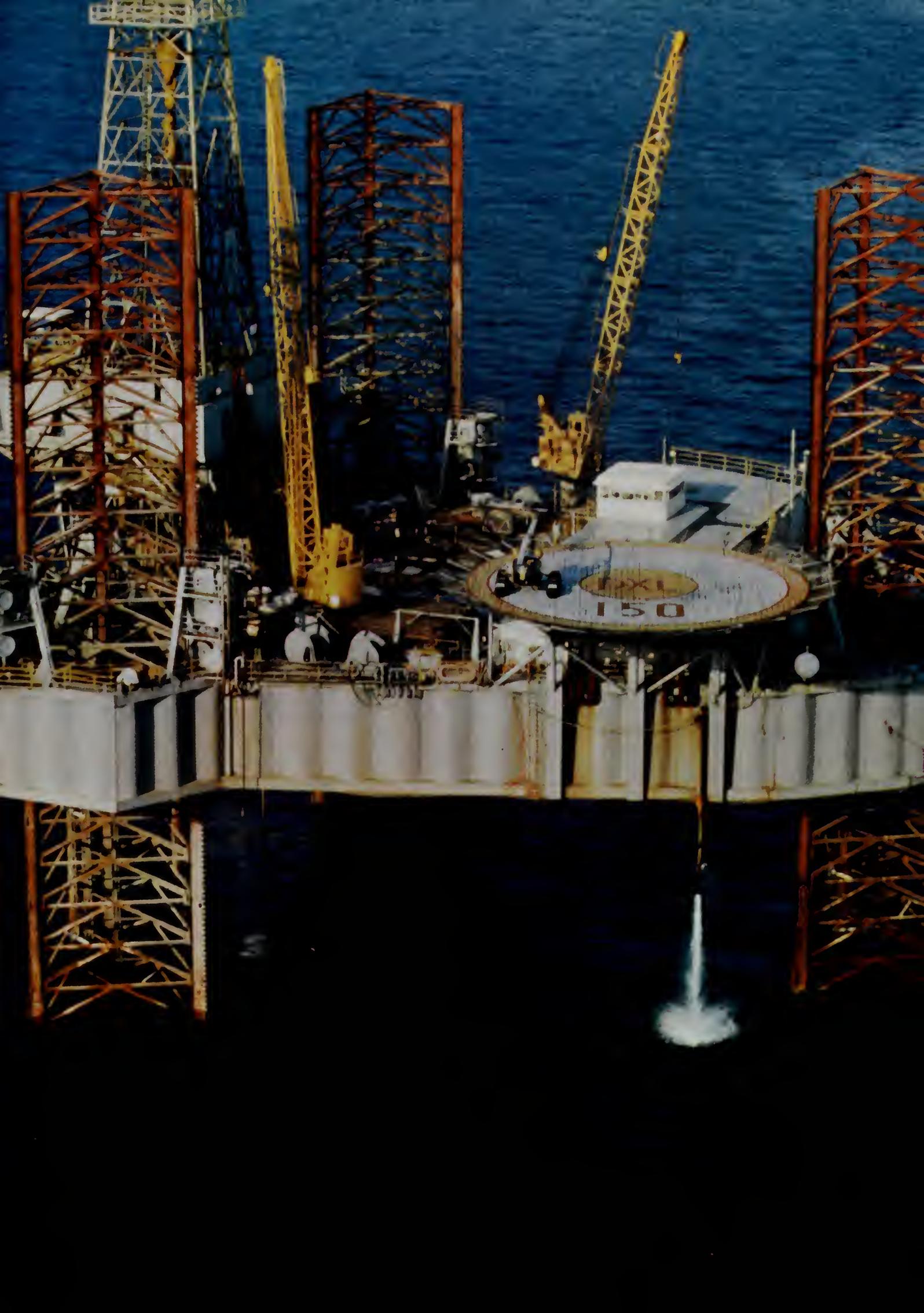
The Continental Shelf is a gently sloping plateau of land that starts at the coastline and runs seaward to a point where there is a sharply defined drop toward the oceanic abyss. The width of this shelf varies from one coastal area to another. In the Gulf of Mexico, it is about 60 miles wide; it extends off the Atlantic coast for approximately 40 miles and narrows to 20 miles off the Pacific coast.

For many years geologists have known of oil and gas deposits in the subterranean structures of the Continental Shelf, and efforts were made to recover it as early as 1920. Because of the value of oil and gas, jurisdictional disputes arose between the States and the Federal government over control of the Continental Shelf. The dispute was settled in principle in 1953 when Congress ceded control of submerged lands out to the three mile limit to the States. (Actually the limit of State jurisdiction was measured in nautical miles, each equal to 1-1/7 statute mile.) The only exception to this limit recognized is a three-league limit, approximately 10 miles, for Texas and Florida in the Gulf of Mexico. In the same year the Federal government declared all submerged lands beyond the three mile limit to be public domain under the jurisdiction of the Federal government.

Since Federal leasing of oil and gas rights on the OCS started in 1954, the Department's Bureau of Land Management (BLM) has leased some 10 million acres of offshore lands. About 3 million acres, or roughly one-third, were leased between 1971 and 1974. The President has called for a 10-fold increase in the leasing program, and the Department is gearing up to meet the challenge.

The 10 million acres already under lease make up a total area about the size of the States of Massachusetts, Connecticut, and Rhode Island, a relatively small area when compared to the total area of the Continental Shelf, which is approximately one-third the size of the United States. However, only a small portion of the OCS has been explored and no assurance exists

Since 1954, Interior has leased 10 million acres of offshore lands, only a small part of the total area of the Continental Shelf. At right is a typical offshore drilling rig off the coast of Texas.



that even a major portion of the Shelf has underlying deposits of oil and gas.

Known reserves on the OCS in 1974 amounted to 5.7 billion barrels of oil and 38.8 trillion cubic feet of natural gas, with the great bulk located off the coasts of Louisiana, Texas, and southern California. From the area already under lease, the Nation to date has recovered 2.8 billion barrels of oil and condensates and 17 trillion cubic feet of gas.

Geologists estimate that the unexplored areas of the Continental Shelf will prove to have between 58 and 116 billion barrels of recoverable oil and between 395 and 790 trillion cubic feet of gas. Most of the estimated reserves are thought to be under Federal jurisdiction.

Against proven reserves and the estimated reserves, we should remember that the United States consumed 6 billion barrels of oil and 23 trillion cubic feet of gas in 1973. We also have been warned that the Nation's oil and gas consumption will rise from 22 to 70 percent by 1985.

If we assume that future discoveries of oil and gas on the OCS fall halfway between the extremes of estimates, and that industry is able to get it into the Nation's pipelines without undue delay, simple arithmetic shows that even at present rates of consumption the Continental Shelf alone can supply our needs for oil for only about 15 years and natural gas for less than 30 years. Fortunately, onshore reserves will also help meet the increasing demand. In 1973 the United States consumed 17 million barrels of oil per day. It produced only 11 million barrels per day during this same period, leaving 6 million barrels per day to be supplied from imports.

Most oil and gas produced from the OCS has come from an area lying off the coast of Louisiana and Texas. In 1973 total production from the OCS averaged 1,081,000

barrels of oil a day and all but 52,000 barrels per day came from the Louisiana-Texas area. The OCS produced 8.9 billion cubic feet of gas in this same period with all but 20 million cubic feet coming from the same area.

But this is also the area having the greatest percentage of offshore land under lease. If the Department is to achieve its goal of leasing 10 million acres per year, frontier areas of the OCS will have to be opened for leasing. Recently BLM called on the oil and gas industry, the academic community, conservation organizations, and the general public to help it decide which areas should be leased first.

Since the purpose of the acceler-

source potential from greatest to least. They are:

- 1, The Gulf of Alaska;
- 2, The Central Gulf of Mexico;
- 3, The Beaufort Sea;
- 4, The Bristol Bay;
- 5, The Southern California Borderland;
- 6, The Eastern Gulf of Mexico;
- 7, The Western Gulf of Mexico;
- 8, The Mid Atlantic;
- 9, The North Atlantic;
- 10, The Santa Barbara Channel;
- 11, The Bering Sea;
- 12, The Chukchi Sea;
- 13, The Cook Inlet;
- 14, The South Atlantic;
- 15, The South Aleutian Shelf;
- 16, North and Central California;
- 17, The Washington and Oregon coast.

Many factors enter into a decision to offer an area for leasing, or a company's decision to bid. A number of companies also ranked



Careful scientific studies are made before and after offshore leasing.

ated leasing program is to help erase the gap between the Nation's consumption of energy and its ability to produce it, any new area opened for leasing should meet the following criteria:

1. It should show geologic and geophysical promise of relatively large deposits of oil and gas.

2. It should lend itself to quick development.

3. It should present minimum environmental risks.

In response to the Department's call for comments, many of the oil companies ranked the 17 possible leasing areas according to their resource potential. BLM compiled these rankings and made up the following list showing the areas thought to have the greatest re-

the 17 possible leasing areas according to their preference for leasing. This ranking took into consideration such factors as markets, available labor supply, available capital, available equipment, favorable climate, legal and political considerations, etc. A compilation of the areas according to company preference follows:

- 1, The Middle Atlantic;
- 2, The Gulf of Alaska;
- 3, The Cook Inlet;
- 4, The Santa Barbara Channel;
- 5, The North Atlantic;
- 6, The Bristol Bay;
- 7, The Beaufort Sea;
- 8, The Chukchi Sea;
- 9, The South Aleutian Shelf;
- 10, The South Atlantic (tie);
- 11, The Bering Shelf;
- 12, The North and Central California Coast;
- 13, The Washington and Oregon Coast.

By considering both resource po-

tential and company preference, BLM came up with the following listing:

1, The Central Gulf of Mexico; 2, The Gulf of Alaska; 3, The West Gulf of Mexico; 3, The Southern California Borderland; 5, The Mid Atlantic; 6, The East Gulf of Mexico; 7, The North Atlantic; 8, The Bristol Bay; 9, The Beaufort Sea; 10, The Santa Barbara Channel; 11, The Cook Inlet; 12, The Bering Sea; 13, The South Atlantic; 14, The Chukchi Sea; 15, The Southern Aleutian Shelf; 16, The North and Central California Coast; 17, The Washington and Oregon Coast.

Environmental groups declined to rank areas according to their desirability for leasing from an environmental point of view. In each case they cited the lack of environmental information as the reason for their reluctance, and cited the need for BLM to gather environmental data prior to offering leases within the area.

In addition to rating the 17 areas according to their desirability for leasing, BLM will continue to follow past practice by asking the oil and gas industry to nominate specific tracts within the general area that they would like offered for leasing. An environmental statement prepared for each sale will make an assessment of each tract. In addition, the public will be invited to point out potential hazards regarding specific tracts. Tracts with high environmental risks will be withdrawn from sale.

The Department budgeted \$2.3 million during fiscal year 1974 for its data gathering program. Fourteen million dollars is budgeted for 1975. In June 1973 the Department awarded five contracts to research agencies to gather and consolidate available data. These studies are concerned with coastal zone climate, ecology, physical properties, man made features, hydrology, and the physical oceanography of the continental shelf, meteorology, geology, and marine ecology.

Socio-economic studies will review industrial and commercial activity, petroleum industrial development, demography, land and water use, sources of pollution, and the existing transportation systems. These studies were completed in June of 1974 with the exception of the southern California study, which was completed in the fall of that year.

Specific areas studied were the North Atlantic, the Mid-Atlantic, the Gulf of Mexico, the Gulf of Alaska, and Southern California.

Additional funds were transferred from BLM to the Council on Environmental Quality for a contract study on a data inventory of the South and East Alaskan coast.

In the Spring of 1974 BLM awarded a contract for baseline and monitoring studies for that area in the Gulf of Mexico leased in a December 1973 sale. This sale offered tracts in an area not previously leased off the coasts of Mississippi, Alabama, and Florida.

During the baseline phase, a study team composed of biologists, chemists, geologists, etc. collected water column and bottom samples prior to the start of any development activity in the area. These samples were analysed for biological, geological, chemical, and physical oceanographic data.

The monitoring phase of the study started after the companies had started to develop their tracts. By comparing data gathered during the monitoring phase with the data gathered during the baseline study, the teams will be able to pinpoint changes in the marine environment that have occurred as a result of the leasing of tracts in that particular area.

This kind of information will help the Department make an environmental assessment of its leasing program and will provide information that can be used to build the necessary stipulations into leasing agreements to prevent undue environmental damage.



Workmen installing a drill bit in preparation for sampling sea bottom.

To better administer the accelerated leasing program and to supervise the necessary environmental studies, BLM has established Outer Continental Shelf Offices in New York City, Los Angeles and Anchorage. These new OCS offices—in addition to the Bureau's long-established OCS office in New Orleans—will be staffed with experts in leasing and environmental phases of the program.

Interior officials have cautioned that the public cannot expect any substantial change in the supply of fuel that will be available in the near future. They estimate that there will be some increase in domestic production by 1980, but that the full impact of increased leasing will not be felt until 1985. Estimates given by the oil companies of the time it will take to achieve initial production after a discovery is made, and of the time it will take to achieve peak production afterward, bear out these predictions.

An automatic counter clicks off the number of barrels of oil delivered.







**GETTING THE MOST
FROM
LAND AND WATER**

Critical Choices Save Shorelines

By James Carroll

In the case of the 12 national seashores and lakeshores administered by the National Park Service, some critical choices already have been made—to preserve the scenic treasures, recreational opportunities, and historical values of these vital, but threatened, areas of our country.

Nowhere are pressures of development more intense in America than along its shorelines. Yet thanks to Congressional actions establishing national seashores and lakeshores, choice areas along the Atlantic, Pacific, and Gulf of Mexico, as well as the Great Lakes, have been preserved in nearly their natural states for the esthetic and recreational enjoyment of millions.

An outstanding example is Assateague Island National Seashore in Maryland and Virginia, a 37-mile-long retreat favored by residents of Washington, Baltimore, and other eastern cities. It is the home of a famous herd of wild ponies. Sika deer, a miniature Japanese elk introduced on the island in 1923, thrive in woodlands and marshes.

Yet developers at one time had subdivided this land, until a storm shattered their dreams in 1962. When Congress authorized Assateague Island as a national seashore in 1965, there were more than 3,500 individual landowners. Now most of

the area is under public ownership.

Fire Island National Seashore, part of a barrier island off the south shore of Long Island, provides 32 miles of beach, wind-twisted pines, and a patchwork of seaside plant communities. Hidden hardwood groves take visitors by surprise.

Today, out of all the coastline around New York City, Fire Island alone remains relatively wild, roadless, and isolated. Long-legged herons stiffly stalk in grassy wetlands, wild geese and brant fly over the salt marsh, and occasionally a startled deer dashes off through tangled thickets. Fishing, clamming, and swimming are popular activities. Guided nature walks are offered in the summer.

Another of the few expanses of uninterrupted natural lands along the Atlantic is the Cape Cod National Seashore. Until the seashore was established in 1961 to more permanently assure its protection, Cape Cod's natural and historic values were preserved by individuals, towns, and the State of Massachusetts.

Man also has chosen to preserve the Apostle Islands in the Wisconsin waters of Lake Superior as a national lakeshore. It was glaciers that created the islands and Lake Superior itself. Here America's northland presents rocky islands in a blue inland sea and forests where dark spruces contrast with pale birches.

It hasn't always been this way. After the Indians, who lived for centuries in harmony with the land, came the lumberjacks, who sheared off the bigger and better trees, and quarrymen who cut sandstone. The commercial fishermen's weathered shacks have tumbled down, the quarries are overgrown, and a luxuriant second growth of trees is spread over these lands.

From Cape Cod, Massachusetts, on the Atlantic, to Point Reyes, California, on the Pacific, the na-



tional seashores also function to maintain important segments of the Nation's history.

Cape Cod was where the pilgrims had their first glimpse of the New World. Some historians believe this is the "Keel Cape" of Thorvald the Viking in 1004. Many historic buildings can be seen in natural surroundings on Cape Cod.

Point Reyes is across the continent in California, but here Sir Francis Drake, on a voyage of exploration and plunder in 1579, sailed his damaged ship, the *Golden Hind*, into a "faire and goode baye" to make repairs.

Another explorer, Don Sebastian Vizcaino, gave this place its name on January 6, 1603. He called it La Punta de las Reyes, the Point of the Kings.

In 1585, Roanoke Island on Cape



Hatteras National Seashore, North Carolina, was the scene of the short-lived first English settlement in the New World. Blackbeard, the most notorious of the pirates on this coast, was killed near Ocracoke Island in the same seashore in 1718. Storms and vandals have carried away most remains of wrecked ships, but bits still remain partly buried in the sands or submerged in the water.

In 1903, on a sand flat at the base of Cape Hatteras' Kill Devil Hill, the Wright brothers made the first successful flight in a powered airplane.

Padre Island, which stretches for 113 miles along the Texas Gulf Coast, is a textbook example of a barrier island, built by wave action and crowned by wind-formed dunes. Winds and strong tides continually change the appearance of the island.

It was discovered in 1519 by Alfonso Alvarez de Pineda who charted the island on behalf of Governor Garay of Jamaica. In 1553, a 20-ship Spanish treasure fleet ran into a hurricane and many of the galleons broke up on Padre Island. Of 300 survivors, only 2 survived the fierce Karankawa Indian attacks and hardships on the march down the coast to Mexico.

Gulf Islands National Seashore, a 150-mile stretch of seashore on

Thirty-seven-mile-long Assateague Island National Seashore in Maryland and Virginia offers great scenic and recreation treasures.



the Gulf of Mexico including a series of offshore islands and keys from Gulfport, Miss., to Destin, Fla., contains the site of the Federal Government's first conservation efforts.

The Naval Live Oak Reservation, in Florida's panhandle, was set aside in 1828 by President John Quincy Adams to conserve live oak trees used in building large wooden sailing ships of that era.

Gulf Islands contains sites of five forts which span the area's history

from Spanish discovery through the Civil War.

Gulf Islands also aptly illustrates another value of the national seashores and lakeshores—their recreation potential—in the form of 52 miles of fine, white "sugar" sand beaches with excellent potential for swimming, picnicking, camping, fishing, skin diving, water skiing, boating, and bird watching.

Ferry boats or more modern vessels such as hydrofoils and air-cushion craft will provide access to

those islands which have no bridge connection to the mainland.

At Point Reyes, individuals may visit the Morgan Horse Farm where self-guided tours are available and interpretive talks and horse training demonstrations are given. Another popular recreation feature: more than 100 miles of hiking trails are found on Point Reyes.

Hiking is possible over most of Padre Island. Many of the hikers are birdwatchers—350 species of birds are year-round residents or seasonal visitors. Waters are warm enough for swimming all year. The



“The health of the eye demands a horizon.”

—Ralph Waldo Emerson

gradual slope of the beach and shallow water make Padre Island safer for swimming than most other seashores.

Fishermen find much delight in national seashores and lakeshores. One favored spot is the Sleeping Bear Dunes National Lakeshore of Michigan, where the true fervor of fishing is displayed during the coho salmon run. This is an exotic and aggressive fish introduced from salt waters.

Visitors also find many recreational opportunities plus scenic splendor at the Pictured Rocks Na-

tional Lakeshore of Michigan's Upper Peninsula and the Indiana Dunes National Lakeshore along the southern shore of Lake Michigan.

Cumberland Island National Seashore off the Georgia coast is the Nation's newest Federal recreation area. Still being prepared for public use, it should become a major recreation area as its facilities are developed within the next few years.

So whatever you are looking for—scenic splendor, recreational

opportunity, or quiet solitude—the national seashores and lakeshores offer something to nearly everyone, and invite the visitor to leisurely exploration. They are advances whose time has come—just in time to preserve some of the good earth so essential to man if his life on this planet is to be worthwhile.

Indiana Dunes National Lakeshore gives a family an opportunity to enjoy a golden-hued sunset.



Our Productive Wilderness

By John Vosburgh

Less than 50 years ago, lumberjacks toppled virgin red spruce trees in the heart of North Carolina's Great Smoky Mountains. Railroads, built deep in the forest, carried out the logs. At Smokemont on the Oconaluftee River, the timber was fed into a \$400,000 sawmill, built in 1920.

Giant steam skidders dragged logs with overhead tow wires extending a mile into the timberland.

The railroads moved their tracks toward the crest of the range and the stands of oak, hickory, beech, yellow-poplar, ash, maple and cherry the Forest Service called "the finest hardwood that ever stood." Sparks from wood-burning locomotives and steam skidders sometimes set the woods on fire. In 1925, fire destroyed extensive timberland in the Forney Creek watershed.

That same year lumbering in this area ceased as the result of a strong national park movement and, in 1926, Congress authorized establishment of a Great Smoky Mountains National Park in North

Carolina and Tennessee. On the Tennessee side, however, logging continued another 13 years in the Tremont and Little River areas where a railroad had been built to carry logs from Elkmont in the mountains to the Townsend mill downriver.

These "right-to-cut" agreements expired in 1938. More than 200,000 acres of the two-State park area had been timbered off in 70 years.

Today Smokemont, Tremont, Elkmont and much of the Oconaluftee and Little Rivers are part of Great Smoky Mountains National Park. The railroads have been torn up and the sawmills dismantled. By



*"Wilderness Areas . . .
are great reservoirs in the
serene order of nature."*

—Donald Culross Peattie



Red spruce now covers much of logged area of early 1900s.

1954 no sign of the lumbering heyday was readily visible, and by 1960 new red spruce 20 feet high covered the logged slopes. Much of the cut portion of the hardwood forest also has restored itself except for the American chestnut which was gradually destroyed by blight starting in 1904. Some of the more severely cut and damaged slopes are now showcases of colorful fall foliage.

Great Smoky Mountains and Shenandoah National Park in Virginia contain a relatively rare type of wilderness—forests once sorely damaged by man but now so fully restored that they meet the 1964 Wilderness Act definition as “an area where the earth and its community of life are untrammled by man, where man himself is a visitor who does not remain. An area . . . with the imprint of man’s work substantially unnoticeable. . . .” (Full definition below).*

Well over a century ago Henry Thoreau observed: “A town is saved, not more by the righteous men in it than by the woods and swamps that surround it.” Walt Whitman, who hailed both nature and industry, predicted: “Without enough wilderness America will change. Democracy . . . must be fibred and vitalized by regular contact with outdoor growth—animals, trees, sun, warmth and free skies—or it will dwindle and pale.”

More than half of the Great Smoky Mountains National Park wilderness, including an unsurpassed virgin hardwood forest, may become part of the National Wilderness Preservation System (NWPS) authorized by the Wilderness Act.

Wilderness preservation has been a fundamental of national park and monument management for more than a century. The national park movement has been a focal point for wilderness philosophy since Yellowstone National Park was es-

tablished in 1872. While much other wilderness has been impaired, national parks and monuments have been managed to restore the wilderness by removal of adverse uses. Some 35 years before restoration of the Great Smoky wilderness began, the new Sequoia National Park, authorized in 1890, was close to permanent destruction. Sheep had ruined the alpine meadows and grasslands. Eroded gullies were numerous.

Vegetation was so scarce that the Army, then operating the park, recommended that infantry replace the cavalry because there wasn’t enough forage to feed the horses. In the ensuing decades, national park management restored both the vegetation and the wilderness to this damaged land.

Congress recognized in the Wilderness Act that wilderness produces “for present and future generations the benefits of an enduring resource. . . .” These benefits range from the clean water and stable soils of a protected watershed to wildlife habitat, from flood prevention to inspiring scenery and the less tangible rewards of quiet solitude, relaxation and meditation—and the challenge of meeting nature under strenuous physical conditions. Such values are not easily expressed in monetary terms. Without such wilderness, future generations could scarcely visualize the types of land pioneers encountered. The National Park System is rich in diverse types of wilderness, and the National Park Service is recommending lands in 58 areas for inclusion in the NWPS.

The 32 million acres in Alaska which the Department has proposed to Congress for addition to the National Park System include some of the world’s greatest wilderness.

The NPS wilderness ranges from 50,000 acres of desert in Petrified Forest National Park, Colorado, now part of the NWPS, to 2.2 million acres of glacier wilderness in

* “A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been

affected primarily by the forces of nature, with the imprint of man’s work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.” (PL 88-577, Sept. 3, 1964, An Act to establish a National Wilderness Preservation System . . .)

Glacier Bay National Monument, Alaska. Other diverse values in NPS wilderness include 79,000 acres of volcanic terrain and thermal features in Lassen Volcanic National Park, California, also in the NWPS, and about 850,000 acres of subtropical everglades marsh and wildlife habitat recommended for wilderness status in Everglades National Park, Florida.

Other NPS productive wilderness includes 834,000 acres of rain forest and coniferous woodlands in Olympic National Park, Washington; 28,000 acres containing some of the last remnants of the original prairie grasslands, in Theodore Roosevelt National Memorial Park, N.D.; 512,000 acres in the Grand Canyon National Park complex in Arizona containing perhaps the world's finest example of erosion-carved wilderness; and 523,000 acres of desert and mountain wilderness in Big Bend National Park, Texas.

Aldo Leopold, the forester who became one of the century's most articulate wilderness advocates, is probably best known for his "A Sand County Almanac," an early ecological classic published after his death. Leopold, who died in 1948, was a contributor to the 1941 Department of the Interior-NPS Yearbook. Writing on "Wilderness Values" he said:

"Wilderness has acquired a value not only because it has become scarce but also because we can get in and out of it, and because we can (if we take the pains) perceive its inner workings."

But "the richest values of wilderness," he said, "lie not in the days of Daniel Boone, nor even in the present, but rather in the future."

Today's NPS wilderness is Exhibit A proving the accuracy of that conclusion.

A lone visitor pauses among wild flowers to marvel at the wonders of the North Cascades in Washington State.



A Helping Hand From Private Initiative

By Emily J. Baldwin

Glacier-sculptured valleys encompassed by majestic mountains dotted with alpine lakes remain safe from steel bulldozers and cement layers and promise an abode of serenity for generations to come.

A bayou, where Southern evergreen forest, Gulf Coast prairie, and tidal salt marsh join in a unique ecological mix, will not be channeled to accommodate drainage needs. Instead, populations of migratory birds will return annually to the bayou, finding their resting place and natural habitat unaltered by man.

A stretch of white water rushes through rustic woodlands and then widens and meanders gracefully through fertile farmlands while, only 10 miles on either side, mushrooming urbanization swallows up the countryside. The river, however, will forever meander free through its natural environs.

In the midst of a bustling metropolis, 90 acres of rolling grasslands provide room to roam, a trail to hike, a pond to fish, and nature to enjoy. No matter how far the asphalt spreads, this patch of green will remain unpaved.

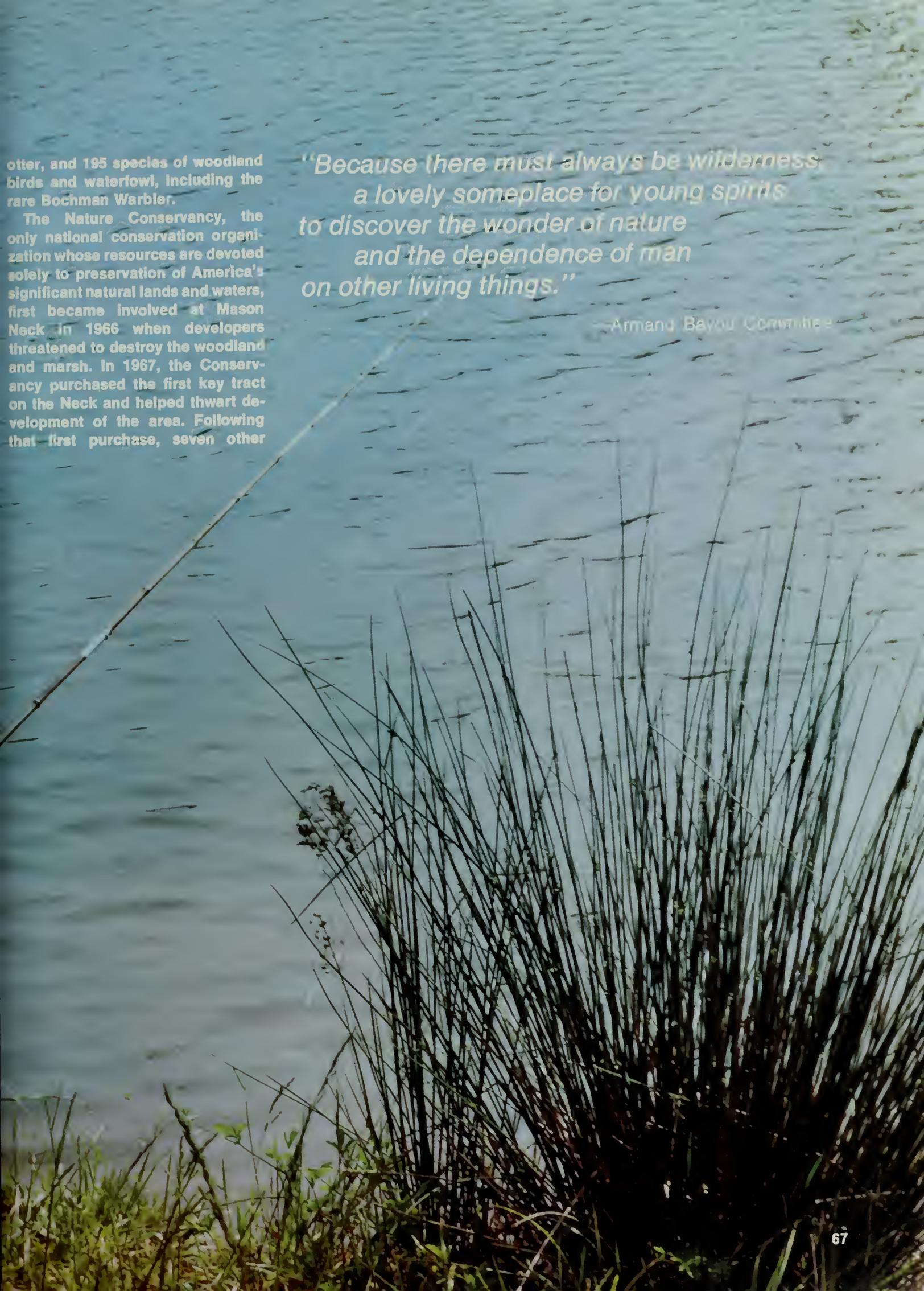
These natural retreats are pieces of an outdoor mosaic which stands as a monument to the conservation and recreation efforts of private individuals and organizations. Their contributions of resources—human, financial, and natural—illustrate a commitment to preserving America's greatest heritage, her lands and waters. The Department of the Interior's Bureau of Outdoor Recreation works hand-in-hand with these private organizations to ensure outdoor recreation and resource preservation—a legacy for America.

The need to preserve environ-

mentally significant natural areas has long been recognized by national and regional conservation organizations. Groups and industries have formed effective partnerships with the Federal Government on behalf of recreation and the environment.

Exemplary of The Nature Conservancy's work is cooperation with the Fish and Wildlife Service in preserving Virginia's Mason Neck National Wildlife Refuge; with the Forest Service in setting aside the valuable Joyce Estate for inclusion in Chippewa National Forest; with the National Park Service in adding the Holzwarth Ranch to Colorado's Rocky Mountain National Park; and, with the Bureau of Outdoor Recreation and the State of North Carolina in preserving the unique Merchant Millpond.

Mason Neck, named for George Mason, a leader of early-day Virginia, whose Gunston Hall home is on the Neck's northern shore, juts out into the Potomac south of Mount Vernon. Characterized by oak and pine woodland and ecologically significant marshes, the Neck hosts nesting sites of the endangered Southern Bald Eagle and provides habitat for deer, bobcat,

A photograph of a bayou with water, reeds, and a wooden post. The water is a light blue-grey color with ripples. In the foreground, there are tall, thin reeds and some green vegetation. A wooden post is visible on the left side, extending from the foreground into the water.

otter, and 195 species of woodland birds and waterfowl, including the rare Bohman Warbler.

The Nature Conservancy, the only national conservation organization whose resources are devoted solely to preservation of America's significant natural lands and waters, first became involved at Mason Neck in 1966 when developers threatened to destroy the woodland and marsh. In 1967, the Conservancy purchased the first key tract on the Neck and helped thwart development of the area. Following that first purchase, seven other

*"Because there must always be wilderness,
a lovely someplace for young spirits
to discover the wonder of nature
and the dependence of man
on other living things."*

Armand Bayou Committee



Joyce Estate was set aside as part of Chippewa National Forest.

properties were acquired and transferred to the Fish and Wildlife Service (FWS), the Commonwealth of Virginia or the Northern Virginia Regional Park Authority, all active on the Neck. On April 10, 1974, the Conservancy announced purchase of another valuable parcel, platted for subdivision and sale as building lots, to be transferred to FWS.

FWS purchased the land at the Conservancy's cost with money from the Federal portion of the Land and Water Conservation Fund, for which the Bureau of Outdoor Recreation serves as banker and Federal manager. Provision of the interim financial support, and negotiation skill necessary to purchase and hold the lands until State and Federal actions could be completed, illustrates the vital part The Nature Conservancy plays in preserving America's outdoor heritage.

Similar support by the Conservancy preserved valuable resource areas for the Forest Service and the National Park Service, the other two Federal recreation land managing agencies which utilize Land and Water Conservation Fund money.

The Joyce Estate, 4,500 acres around Spider, Trout, Wabana, and Johnson Lakes in Minnesota, was purchased and held by the Conservancy until the Forest Service could program L&WCF money to buy the property for inclusion in Chippewa National Forest.

Boasting woodlands of pine, northern hardwood, white birch, and aspen, the forests of the Joyce Estate have been uncut since 1925. The clear, turquoise waters of Trout Lake are unexcelled in Minnesota and are ideally suited for water sports. The tract, valued at almost \$2 million, was so well recognized for its natural qualities that Northwestern National Life Insurance Company of Minneapolis lent money to the Conservancy for interim purchase until the Forest Service could make the addition to Chippewa National Forest.

The 634-acre Holzwarth Ranch in the Kawuneeche Valley contains two meandering miles of the Colorado's scenic headwaters and has been described as a vital addition to Rocky Mountain National Park. The original 1904 Holzwarth homestead remains intact on the property and is highly typical of the homesteading efforts of the first settlers of this valley.

Pending passage of legislation by the Congress to include the ranch in Rocky Mountain National Park and subsequent acquisition with L&WCF money by the Park Service, The Nature Conservancy bought the Holzwarth property with special financing from the First National Bank of Denver to retain its wilderness and historic qualities for generations to come.

Mason Neck, the Joyce Estate, and the Holzwarth Ranch provide outstanding illustrations of how The Nature Conservancy and groups like it assist the Federal Government to round out the national recreation estate with resources of superlative environmental and recreation value. Private support helps make the Land and Water Conservation Fund the most effective Federal funding source for recreation land acquisition.

The Conservancy is also active with States in preserving valuable land tracts and making recreation opportunities available. A classic example of the private-State-Fed-

eral partnership nurtured by the State portion of the Land and Water Conservation Fund is preservation of North Carolina's Merchant Millpond.

The Merchant Millpond area includes a narrow, virgin bald cypress swamp, a larger old growth cypress-gum swamp, and a quiet millpond spotted with gum and cypress trees and many small islands. Surrounding the pond and swamp is a mature hardwood forest. Two parcels of the Millpond area, a 1,000-acre tract near Gatesville and a 6,000-acre segment at Chowan Swamp, were transferred from the Georgia-Pacific Corporation to The Nature Conservancy, one by donation, the other by "bargain sale," to prohibit commercial timber production. Plans call for transfer of the land to the State for inclusion in the Merchant Millpond State Park, an outstanding natural area created with assistance from the Land and Water Conservation Fund.

Replete with recreation opportunities, the Millpond will offer facilities for canoeing, camping, hiking, horseback riding, and controlled hunting. This North Carolina project shows that conservation, business, and government can work together to preserve America's outstanding natural lands, and achieve a remarkably balanced understanding of economic values and natural resource conservation values.

State and regional nonprofit private organizations dedicate much time, effort, and money to the preservation of land, forests, and waters for public use and enjoyment. The Western Pennsylvania Conservancy is one such organization that has effectively used land banking in partnership with the State and Federal Governments to set aside valuable parkland for the outdoor enjoyment of millions.

In early 1974, a \$1.5 million L&WCF grant helped the Commonwealth of Pennsylvania acquire 9,355 acres of the Mountain Streams site on the west slope of Laurel

Ridge in Westmoreland and Somerset Counties. This valuable natural site in the midst of the growing Pittsburgh-Johnstown metropolitan area was purchased first by The Western Pennsylvania Conservancy to keep the area free of commercial and residential development until the State could obtain adequate funds to include the site in its State park system. BOR provided financial support with a L&WCF grant, and The Western Pennsylvania Conservancy donated half the value of the acreage to be used as the State's matching share of the project costs. The Mountain Streams site will provide a host of recreation opportunities for the 3.5 million people who live within an hour's drive.

Private organizations such as The Nature Conservancy and The Western Pennsylvania Conservancy work to preserve a variety of significant land and water resources. In many instances, however, the natural quality of a particular resource is threatened by development pressures, and citizens band together to save that specific land or water area from destruction and keep it available for generations to come. Such is the case with Little Miami, Inc., (LMI) and the Preservation of the Armand Bayou Committee.

People in southwestern Ohio have always had a deep love and appreciation for the scenic beauty of the Little Miami, a river remarkably untouched by the urbanization which surrounds its valley. Fears that this treasure of nature would be lost to development led, in 1967, to creation of Little Miami, Inc., a nonprofit organization formed to promote preservation of the Little Miami River in its natural state and to promote and encourage protective State and Federal legislation.

LMI's first victory came in early 1968 when the Ohio Legislature established a State system of scenic rivers. Growing interest in the Little Miami was responsible for its inclu-

sion as a river to be studied under the National Wild and Scenic Rivers Act passed by Congress later that same year.

An all-out effort to put the issue of the river's preservation before the public was launched. Canoe races were held and river clean-up campaigns sponsored. LMI members spoke before hundreds of local clubs and civic organizations. Today, the LMI has more than 2000 members and the backing and support of about 240 organizations and institutions.

Between 1969 and 1971, the entire length of the Little Miami was designated, in three phases, as a part of the Ohio scenic rivers system. BOR, which has responsibility in the Interior Department for studies involving the National Wild and Scenic Rivers System, led an intensive analysis of the Little Miami to determine if it possessed the outstanding river qualities necessary for inclusion in the National System. Then, in 1973, Secretary of the Interior Morton designated a major portion of the Little Miami as a National Scenic River.

Little Miami, Inc., continues to work with the State in implementing the protection plan for the river. To thwart proposed development projects within the river corridor, LMI encourages donations of land along the river for transfer to State or local jurisdictions. Through the efforts of Little Miami, Inc., and the State and Federal Governments, the Little Miami will run wild and free through her valley for generations.

"A rare, untouched 3,000 acres of bayou in the greater Houston area we ask you to help preserve. Because there must always be wilderness, a lovely someplace for young spirits to discover the wonder of nature and the dependence of man on other living things." This is the call of the Preservation of the Armand Bayou Committee.

Preservation of Armand Bayou, one of the last natural watersheds

in the Gulf Coast, has been planned for several years. As the first concrete step in preserving the Bayou, the City of Pasadena, Texas, acquired 955 acres with support from a Department of Housing and Urban Development open space grant. The County of Harris will acquire an additional 1,203 acres with \$2.68 million from the Land and Water Conservation Fund.

To help the County supply the necessary funds to match the Federal grant, the Preservation of the Armand Bayou Committee has solicited nearly \$500,000 in private contributions. The Committee has gained outstanding public support to preserve the Armand Bayou as a complete working ecological system.

Located in southeast Harris County, the Bayou begins in the City of Pasadena and meanders 17 miles southward to Clear Lake, adjacent to Galveston Bay. A mixture of natural habitats, the Bayou supports a rich variety of plant and animal life. Opportunities for hiking, biking, picnicking, boating, and nature study will help service the outdoor recreation needs of nearly 2 million residents of Houston's expanding urban center.

Without the efforts of the Preservation of the Armand Bayou Committee, this unique natural watershed in the midst of an urban center could have been changed by

Learning intricacies of a unique national watershed, Galveston residents enjoy nature hikes along Armand Bayou.



the bulldozer and covered with commercial and residential development.

Private enterprise also has played an important role in the provision of lands and facilities to meet America's ever-growing demand for outdoor recreation opportunities. Through outright donations, opening of company lands for public recreation use, and demonstrations of concern for scenic resources within the boundaries of company land, private enterprise's substantial contributions to this Nation's natural heritage have shown good corporate citizenship and concern for the environment.

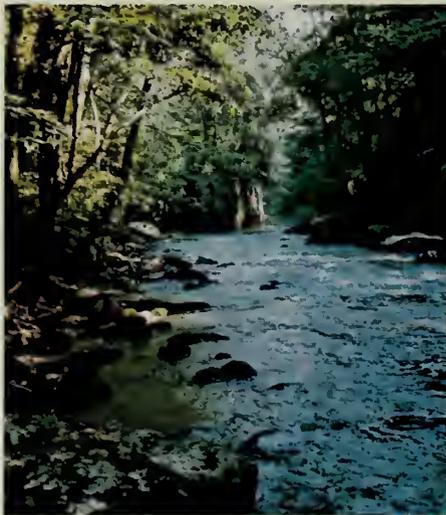
Exemplary of corporate donations for public outdoor recreation are: donation by the Anaconda Reduction Works of a 7-acre tract, valued at \$225,000, to the City of Anaconda, Montana, for a multiuse park; donation by the Peabody Coal Company of a 1,028-acre former strip mine property to the State of Missouri for a new State park, illustrating Interior's reclamation-for-recreation effort; and, donation by the First National Bank of Missoula of a 9-acre island property to the City of Missoula, Montana, for an urban recreation site. In each case, the value of the donated land enabled the locale to match a L&WCF grant from BOR to develop the areas as public recreation sites.

The Nation's Northwest region boasts an assortment of river resources, including the Illinois, the Rogue, the Deschutes, the Klamath, and the Swan. Recognizing the recreation value of these river areas, the Pacific Power and Light Company donated important river-side sites to government agencies for use as parklands and opened its own lands, wherever possible, for public recreation use.

Pacific Power and Light began making its lands available for recreation in 1934. Since that time, the company has opened lands along the Deschutes River, the Klamath

River, and at Hood River, Oregon; and along the Swan River in Montana.

The Illinois River in Oregon, a potential National Wild and Scenic River, offers natural beauty and recreation opportunities for the Northwest. To preserve the scenic values of the river environs, PP&L donated a 130-acre site, Pine Flatte, to the Forest Service. PP&L also purchased the 159-acre Hell Gate Canyon along the Rogue River, never developed the area, and donated it to the Secretary of the Interior for river recreation.



Roaming free through her valley, the Little Miami River in Ohio provides serenity and enjoyment for urban residents who live close by.

The Ohio Edison Company also made important contributions. Little Beaver Creek, an unspoiled Ohio river, was designated for study and possible addition to the National Wild and Scenic Rivers System. Ohio Edison of Akron became aware of the BOR's river study while gaining rights-of-way for two high-power electric transmission lines to cross the creek. Even though options on much of the proposed right-of-way had already been obtained, the company voluntarily changed its plans to avoid crossing the scenic portions of the North and West Forks of Little Beaver Creek.

The Bowaters Southern Paper Corporation has led the way in preserving areas of pocket wilderness and developing hiking trails on private timber lands. Through a policy of multiple-use forest land management, Bowaters has recognized that recreation use of its lands is compatible with its economic values.

Bowaters now has 1,100 acres of pocket wilderness—parcels of land set aside for preservation in their natural state, with no logging or developments other than hiking trails permitted within their boundaries. Within these wilderness settings, Bowaters has developed five hiking trails, three of which have gained National Recreation Trail status.

Included in the National Trails System (a primary responsibility of BOR) are the 8-mile Laurel Snow Trail, the 8-mile Virgin Falls Trail, and the 5-mile Honey Creek Trail in southeastern Tennessee. All three, maintained by the Bowaters Corporation, offer wilderness and hiking experiences within easy reach of Chattanooga, Cleveland and Athens, Tennessee.

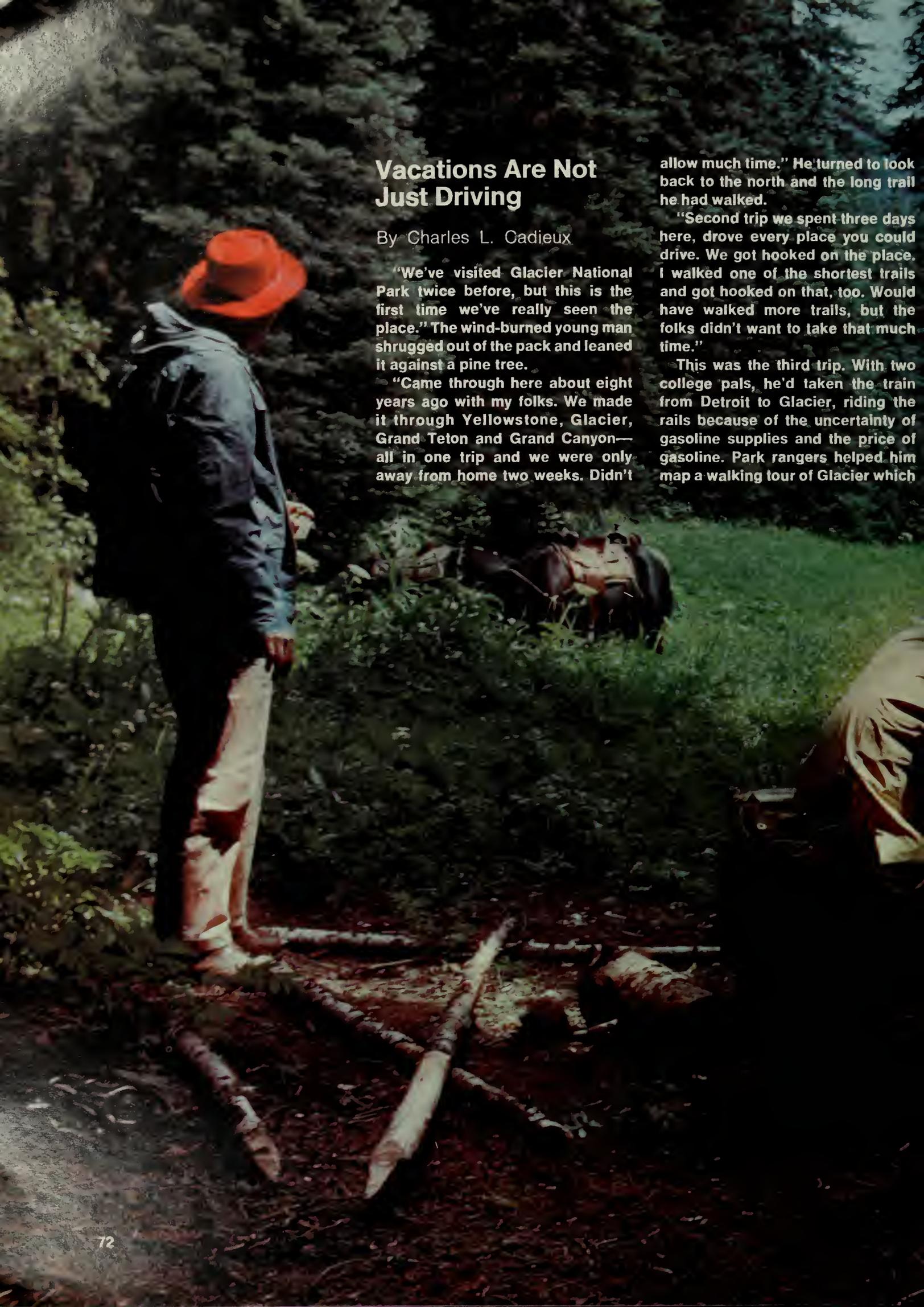
Private contributions to our outdoor recreation heritage are vast and varied. No matter how structured or informal the organization, private efforts all represent concern—for our environment, for outdoor recreation opportunities, for our natural heritage. The Congressionally-mandated Nationwide Outdoor Recreation Plan, "Outdoor Recreation—A Legacy for America," recognizes the contributions of the private sector and encourages increased participation in the government-private joint venture on behalf of outdoor America.

This joint venture can greatly help this generation ensure a balance of economic and environmental concerns in the future. Conservation, business and government working together today can provide a rich heritage of recreation lands and waters for tomorrow. They share a common responsibility for many of the choices ahead.



“In the woods is perpetual youth.”

—Unknown

A man wearing a red hat and a blue jacket stands in a forest, looking towards a horse and saddle on the ground. The scene is set in a lush, green environment with dense foliage and trees. The man is standing on a path or clearing, and the horse and saddle are positioned in the middle ground. The overall atmosphere is serene and natural.

Vacations Are Not Just Driving

By Charles L. Cadieux

"We've visited Glacier National Park twice before, but this is the first time we've really seen the place." The wind-burned young man shrugged out of the pack and leaned it against a pine tree.

"Came through here about eight years ago with my folks. We made it through Yellowstone, Glacier, Grand Teton and Grand Canyon—all in one trip and we were only away from home two weeks. Didn't

allow much time." He turned to look back to the north and the long trail he had walked.

"Second trip we spent three days here, drove every place you could drive. We got hooked on the place. I walked one of the shortest trails and got hooked on that, too. Would have walked more trails, but the folks didn't want to take that much time."

This was the third trip. With two college pals, he'd taken the train from Detroit to Glacier, riding the rails because of the uncertainty of gasoline supplies and the price of gasoline. Park rangers helped him map a walking tour of Glacier which

let him see as much of the high country as possible—with a leisurely pace which kept the hiking within safe limits and still got him out of the back country to catch his train for Detroit. He had taken time to earn priceless memories, a big-horn ram etched against a timberline sunset, a fighting trout from icy waters, clean air and majestic peace and solitude of the mountains. He had taken time to see Glacier.



Getting to Glacier by rail is not new. The first visitors who came in any numbers came by rail and the railroad still offers a good first look at the park.

What is new is the “use your time, not your gasoline” visitation which National Parks are experiencing. It includes much less automobile driving to reach the park, much less car travel inside the park and more use of the transportation furnished by the park. People now leave the automobile in the parking lot for days at a time. The new visitor doesn't spend time, he invests time in studying the glories of the park.

If the fossil fuel shortage taught us this new concept, then it has not been all bad. For the new type of visitor isn't limited to the big mountain parks of the West.

At Minute Man National Historical Park, Massachusetts, the young family was leaving the Visitor Reception Center when the youngster asked, “Aren't we gonna get to see them shoot the muskets?”

His father answered, “I'm afraid not, son; that's more than an hour from now and we haven't got that much time.”

They were halfway back to the parking lot when the wife asked, “Why haven't we got the time? I thought we were on vacation.” They invested an hour to tour the exhibits interpreting the story of Minute Man, then came back for the firing of the colonials' muskets. That got them more interested and they devoted the remainder of the day to walking through these hallowed shrines of America's revolutionary beginnings. As they were leaving, the young boy said, “This is lots better'n last year—all we did then was drive, drive, drive.”

After his parents stopped laughing at the remark, the father said, “You know, it's places like this that make me proud to be an American. . . . I'm glad we took the time to learn about it.”

Maybe Americans are maturing



as a people, advancing to the point where the emphasis on speed and distance will give way to seeing and learning on vacation travels. If this is true, national parks offer much to vacationers who will take time to see.

You can get acquainted with the Rocky Mountain marmot at Glacier National Park, if you'll take the time to approach him slowly and quietly—and you can watch moose at close quarters if you'll take time to enjoy the boat ride out to Isle Royale National Park and then walk along the foot trails into the interior of this big island in Lake Superior. You can enjoy the sunset over a mirror-smooth lake, amid silence broken only by the cry of a loon—if you'll take time to canoe into Voyageurs National Park.

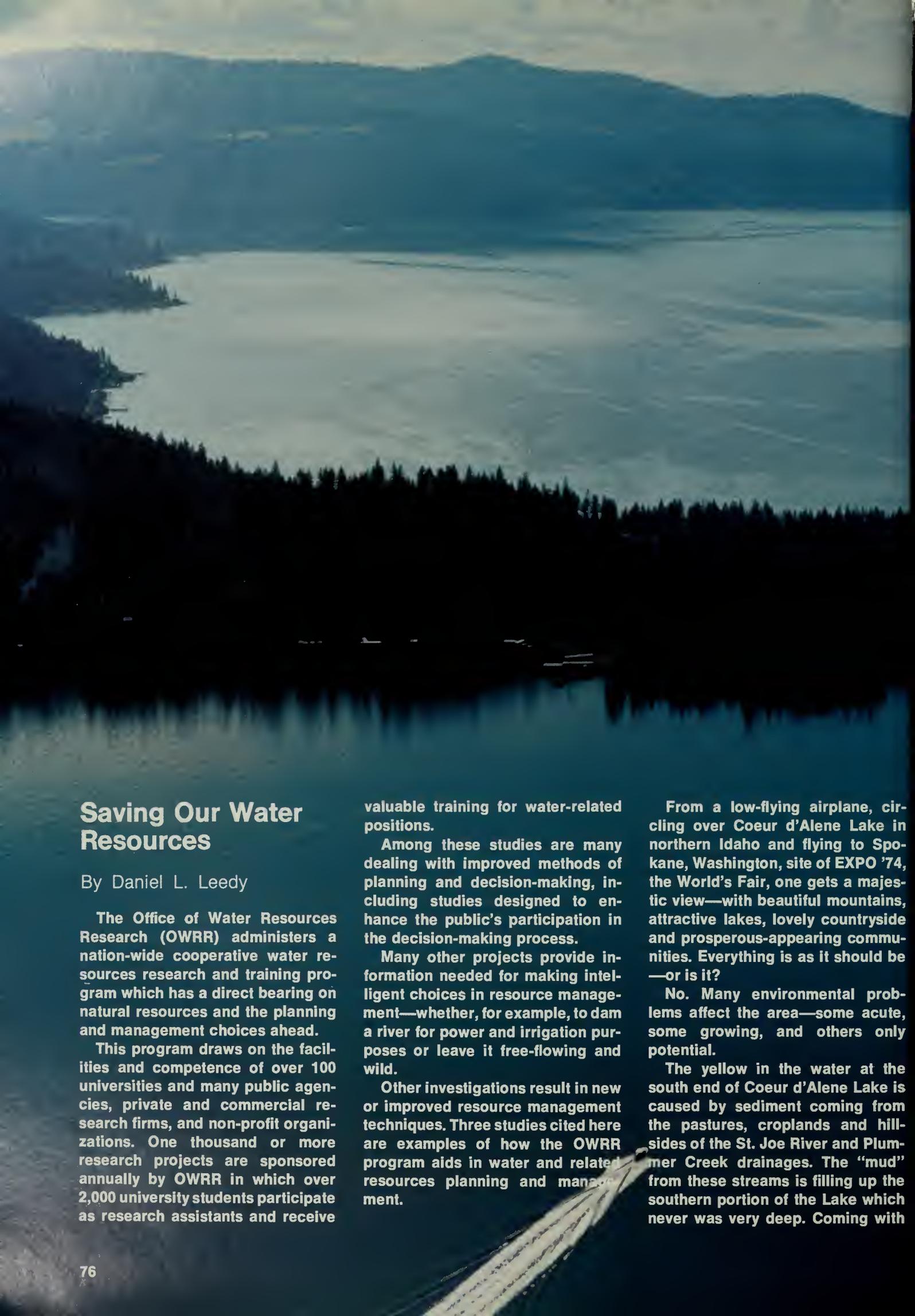
You can walk through the hallways of a civilization which preceded ours by a thousand years, if you'll take time to ride the National Park Service mini-bus into Mesa Verde, or if you'll walk the winding trail down to White House Ruins in Canyon de Chelly, or if you'll take time to drive 21 miles of back road to reach Chaco Canyon—once the most populous city in North America.

Even if you are an experienced traveler, there is a whole new America to visit. It's easy to reach. You don't have to spend a lot of time driving. You do need to invest a little time in the richness of America's heritage. If you do, you'll learn that there's more to a vacation than driving.



In many different ways people show that vacations are not just driving. Left, canoers along the Ozark National Scenic Riverways; above, viewers watch the firing of colonial-type muskets at Minute Man National Historical Park; and right, a visitor getting acquainted with a Rocky Mountain marmot in Glacier National Park.





Saving Our Water Resources

By Daniel L. Leedy

The Office of Water Resources Research (OWRR) administers a nation-wide cooperative water resources research and training program which has a direct bearing on natural resources and the planning and management choices ahead.

This program draws on the facilities and competence of over 100 universities and many public agencies, private and commercial research firms, and non-profit organizations. One thousand or more research projects are sponsored annually by OWRR in which over 2,000 university students participate as research assistants and receive

valuable training for water-related positions.

Among these studies are many dealing with improved methods of planning and decision-making, including studies designed to enhance the public's participation in the decision-making process.

Many other projects provide information needed for making intelligent choices in resource management—whether, for example, to dam a river for power and irrigation purposes or leave it free-flowing and wild.

Other investigations result in new or improved resource management techniques. Three studies cited here are examples of how the OWRR program aids in water and related resources planning and management.

From a low-flying airplane, circling over Coeur d'Alene Lake in northern Idaho and flying to Spokane, Washington, site of EXPO '74, the World's Fair, one gets a majestic view—with beautiful mountains, attractive lakes, lovely countryside and prosperous-appearing communities. Everything is as it should be—or is it?

No. Many environmental problems affect the area—some acute, some growing, and others only potential.

The yellow in the water at the south end of Coeur d'Alene Lake is caused by sediment coming from the pastures, croplands and hillsides of the St. Joe River and Plummer Creek drainages. The "mud" from these streams is filling up the southern portion of the Lake which never was very deep. Coming with



the sediment are the chemical components of agricultural pesticides and fertilizers which, together with the wastes from the many houseboats along the shore and the septic tank effluent from cabins along the Lake, contribute to over-enrichment or eutrophication.

The bright green seen in the waters of the Main and South Forks of the Coeur d'Alene River comes from mining and smelting wastes—zinc, cadmium and copper—being carried along in solution. Attempts made by holding ponds to keep heavy metal wastes from entering the Lake have not been fully successful.

The Spokane River, which flows from Coeur d'Alene Lake through Spokane and on to the great Columbia River, picks up more wastes along the way, particularly at Spo-

kane, which is constructing a secondary treatment plant for its wastes.

Citizens of northern Idaho and eastern Washington owe much, both economically and esthetically, to the streams and lakes of this region. The well-being of these aquatic resources are too important to be left to random development.

An OWRR-sponsored study being conducted jointly by a multidisciplinary team of researchers from the University of Idaho and Washington State University is developing much information on water quality trends, the sources and fate of pollutants, and what is needed to return the river and lake resources to a high quality level and maintain them at this level in the face of development and population increases.

Researchers have met with the Spokane City Council, the State of Washington Department of Ecology, the U.S. Environmental Protection Agency, and others to apply their findings toward solving water quality problems.

In October 1968, Congress passed Public Law 90-542, the Wild and Scenic Rivers Act, declaring that a policy of building Federal dams and other public works on rivers needed to be balanced by a policy of preserving and protecting other rivers in their free-flowing condition so that they and their immediate en-

Beautiful Coeur d'Alene Lake in northern Idaho has picturesque appeal, but a closer look reveals the lake's water quality has been hurt by mining operations, agricultural runoff and human waste disposal.

vironment might be enjoyed by present and future generations.

The Act provided for "instant" and "study" rivers, the instant rivers being those included immediately in the Wild and Scenic Rivers System and the study rivers those on which there is a moratorium on development until 1978, pending studies to be made to decide the eligibility and desirability for their inclusion in the National System.

Because Idaho has several rivers already in the System or designated as study rivers, the Water Resources Research Institute at the University

A series of reports stemming from this investigation has been used by the U.S. Forest Service in its study of the Salmon River in terms of the Wild and Scenic Rivers Act. Procedure developed by the Idaho Institute permits one to quantify in terms of net benefits the trade-offs between competing resource uses. The methodology recognizes that the ultimate decision to preserve a wild and scenic river rests largely on a political value judgment. However, choices made by the people with respect to resource management may be based

lent sport fishing. It is used heavily for recreation, having at least six developed swimming areas and numerous homes and cottages along its shores.

Although algae blooms had appeared in the Chowan in the past, their growth increased dramatically in the summers of 1972 and 1973, indicating that serious environmental changes had occurred in the river. Local newspapers reported floating islands of dying algae a quarter-acre in size, dead fish on the shores, and a stench in the air. A chorus of complaints from shoreline residents suggested that fishing had been ruined, beaches fouled and water sports threatened. Some believed that nitrogen and phosphorus-rich wastes from a fertilizer plant up-stream had triggered the extensive bloom. There was a problem, that is certain. Meanwhile, elected and appointed officials, farmers, fishermen, sportsmen and local residents attempted to find solutions to apparently worsening conditions.

Inasmuch as the Chowan River is an interstate stream, the North Carolina Office of Water and Air Resources, the Virginia Water Control Board, officials of EPA, U.S. Geological Survey and the North Carolina Water Resources Research Institute held meetings that led to an overall State-Federal-university program for a comprehensive study of the Chowan problem. The objective of the program is to firmly establish causal relationships between waste inputs and effects on water quality. The North Carolina and Virginia Water Resources Research Institutes, having conducted several investigations involving eutrophication of estuaries, are well-equipped to supply information on which wise choices in managing the Chowan River Estuary can be based. Their findings and recommendations may prove highly valuable to residents of the Albemarle Region.



Washington State University and University of Idaho researchers use specially equipped boats to sample water and deposits of Coeur d'Alene Lake. Mining operations are a primary source of pollution in the lake and holding ponds, such as the one shown at right, do not keep all heavy metal wastes out of lake.

of Idaho organized a Scenic Rivers Study Unit to develop methodology for decision-making and planning in the selection, use, and management of rivers in the National System. With support from OWRR, the Institute investigated the Salmon River as a test case.

First, the Institute attempted to establish net values for alternative resource uses in the Salmon River Basin. The values were then compared to determine which provided the largest net benefits. The two competing resource uses were identified as hydroelectric power production and recreation. Final step in the methodology determined the trade-offs between outdoor recreation and hydroelectric power production for the Salmon River.

on a better understanding of the possible consequences as a result of these Idaho studies.

Problems of environmental protection, a high priority objective of the Interior Department, are by no means confined to the West or mountainous areas. Along the Atlantic Coast and elsewhere, highly productive wetlands and estuarine areas, so valuable for fish and wildlife and recreation, are being lost through dredging, filling, draining, and development, or are being degraded through pollutants and over-enrichment. The Chowan River estuary is one of the most important natural resources of the Albemarle Region of North Carolina. The estuary supports a major commercial fishing industry and excel-

A New Dimension In Biological Services

By Kenneth E. Black

You'd hardly notice it unless someone pointed it out to you. A guy buys a piece of shorefront property in Maryland . . . California . . . Maine . . . Florida . . . anywhere along the coast.

His next move: build a bulkhead to stop shoreline erosion or a dock for his boat. "Nothing wrong with that," you'd say. "It's the fulfillment of the American dream, a place of his own to escape to."

Still, his and similar actions can have a tremendous "ripple" effect. On the Chesapeake Bay, for example, the Fish and Wildlife Service reviewed all requests for shoreline changes—and most involved less than a hundred feet—over a two-year period. If all had been granted, 120 miles of salt marsh would have been permanently destroyed. Salt marsh is the natural nursery for tiny marine life that sustains fish, birds, and small mammals. Without it, food and shelter vanish, and so does our wildlife heritage.

Or, let's look at it from another angle. Remember Hurricane Agnes along the East Coast in 1972? Heavy rains drenched many areas; floods ravaged many locales; and streams overflowed their banks, silting up and changing course.

After the skies cleared, the clean-up began. Local governments and private citizens joined forces to repair the damage. They draglined silted creeks, and while they were at it, decided to straighten out many of the streams to get better use of the adjacent land. The net effect of hundreds of local actions like that was disastrous to freshwater habitats of trout, bass, and other fish native to the East Coast.

Along the great Mississippi, life-line of midwestern commerce, traf-



Land developments severely impact and often destroy fish and wildlife habitats (top); illegal dredging and drilling on the Texas Gulf Coast permanently destroyed 325 acres of productive fish and wildlife habitat, including the silted oyster reef shown (center); and digging out river bottoms for sand destroys aquatic and streamside habitats, as shown below.

fic moves around the clock—barges, tankers, ore carriers, tugs. Traffic has to be kept moving—many enterprises depend on it, and much of our way of life is wrapped up in it. Shipping channels have to be kept open, which requires dredging. Dredging means that whatever is cleared out of the channel must be disposed of, and the challenge facing the Fish and Wildlife Service is to effect a reasonable compromise on what to do with the material. Only a limited amount can be used for filling in shorelines because so much of the Mississippi's fish and wildlife depend on those same shorelines for nesting, feeding, and spawning.

Everybody gets excited about proposed construction of a powerplant, and it may become a hot local issue—sometimes of regional or national interest for conservationists and developers of energy alike. If the present energy growth rate continues, the United States will require almost twice as much energy by 1985 as it used in 1970. That increase translates into the need to build many more powerplants. Most of them will be proposed for construction next to biologically productive lakes, streams, and rivers. Extensive land will be required and massive water volumes will be needed for cooling. The challenge is clear: More electric power production is needed, but at the same time its effect on fish and wildlife must be minimized, and surplus heat used to biological advantage when appropriate.

And what about oil production? The Nation must have it. The Federal Government, beginning in 1975, proposes to lease 10 million acres each year under the ocean on the Outer Continental Shelf. Production would have a major effect on fish and wildlife values. Habitat will, of necessity, be changed in ocean areas of oil development. But, beyond that, the building of pipelines, tank farms, refineries, port facilities, and docks will affect estuaries and

shorelines. Those coastal areas that will be affected support much of the Nation's fishery resources by supplying microscopic foods and other critical requirements. They also serve as nesting, feeding, and resting areas for migratory birds, and provide habitat for furbearers and marine mammals.

Super-heated rock and water under the crust of the earth—geothermal energy—may prove an excellent source of energy. Eventually, an entire industry may spring up around that resource in the Western States, possibly involving several million acres of land in the production of electric power, usable



Nature study in a tidal marsh.

heat, and mineral byproducts. Such development has the potential of noise pollution, air contamination from gases, pollution of surface and ground waters, and disturbance of ground cover. Moreover, roads, wells, pipelines, transmission lines, and industrial plants will have to be built. Wildlife will be the first to be affected.

Admittedly, the challenges are broad and somewhat frightening. How nature functions and how natural systems respond to human manipulation are not always well understood. Can we change the environment that much and get away with it? Will future generations pay for our demand for luxury and comfort today? No one knows for certain.

To give Americans a better means of weighing the pros and cons, the Fish and Wildlife Service has begun a nationwide program devoted sole-

ly to assessing the biological impact of man's future moves. It is organized to deal with a wide range of specific areas such as oil development, coastal ecosystems and powerplant construction. The agency has assembled and deployed about 200 professional personnel in many fields to lay the groundwork for the future. Their first job is to gather basic scientific data and evaluate the causes and results of all kinds of past and current impacts on the fish and wildlife resource. With this base line information—a summary of the current condition of the resource—the Service hopes to predict with fair accuracy what effect particular changes may have on fish and wildlife. Then, when it's time to draw blueprints and make the final decision, citizens can judge the price they will have to pay for progress.

Paying the price is a responsibility of each American, but so is the responsibility for helping make the final decision. Each person, under today's laws, has the opportunity to express his views on any project that may significantly affect the environment.

If a major new action involving Federal responsibilities is proposed for your locale, public participation will be sought and you can become involved. When public hearings are held, you can find out what the experts say about basic biological facts because they will be published and discussed by the Fish and Wildlife Service. Then you can help decide if the project is worth the price. Arguments and the known facts will be aired publicly, with experts and ordinary citizens alike sharing in the responsibility for the project and the protection given the environment.

Birdwatching is becoming increasingly popular. Right, a group at the Upper Mississippi River Wildlife and Fish Refuge has spotted a flying friend that holds its interest.





Canoeing on waters of the Okefenokee National Wildlife Refuge.

Wildlife and Man's Uncertain Balance

By James W. Pulliam, Jr.

When the number of visitors to National Wildlife Refuges are counted in the millions, wildlife or man must give up something. Annual visits to refuges total about 25 million people.

Increases in waterskiers, picnickers, and campers at refuges represent only a small sample of the growing number of Americans seeking outdoor recreation.

The sparks fly, though, when the Fish and Wildlife Service—obliged by law to give first priority to wildlife—tries to reconcile its primary mission with its human clientele.

Waterskiing and marsh ecology don't necessarily mix. Sunbathing

and surfing, more often than not, conflict with shorebird beachnesting. Desert dune buggies and endangered prairie chickens don't get along together.

And that's the crunch. Where should the line be drawn between wildlife and people? Our system of National Wildlife Refuges cannot operate to the total exclusion of people in a democracy such as ours. Yet, those who manage these sanctuaries are simply caretakers of what belongs to all Americans—a heritage of native wildlife resources.

A basic intent of the Fish and Wildlife Service is to ensure that people have access to the intangible qualities of enjoying wildlife. No one should be denied the opportunity to stand silently on a marsh edge at dawn and hear the wind rustle the wing feathers of a thousand Canada geese "getting up" to

feed. No one should be refused an hour of solitude in a desert wilderness.

Accordingly, the Service has fashioned an approach to public use that balances needs of wildlife and man. Wildlife-related recreation is the key.

Development of this approach was brought about by an amazing increase in recent years in the number of visits to National Wildlife Refuges. During 1973, five refuges had more than a million visitors. Another 17 had a quarter of a million or more. The balance between wildlife and man was threatened by this increase in public use, and the agency had to devise reasonable solutions.

The Fish and Wildlife Service reviewed the kinds of recreation that people seek on refuges. It showed that almost as many people used

refuges for picnicking, swimming, boating, off-road vehicle driving, and camping as for recreation directly related to wildlife.

Further, many refuges had become "the ole swimmin' hole" for particular locales. This kind of activity could not be summarily cut off without proper consideration of a community's recreation needs. It was decided that, in all fairness, activities unrelated to wildlife would be phased out slowly or held to a minimum. Wildlife related uses would be encouraged. These would include fishing, hunting—carefully tailored to the particular area—birdwatching, nature interpretation, photography, environmental education, and hiking and driving. Other uses, less universal, include special studies by conservation groups and research projects on moose, bear, eagles, migratory waterfowl, and other wildlife species which are carried out by graduate students in Alaska and at other refuges.

Thus, National Wildlife Refuges—more than 350 of them covering 30 million acres—will remain open to the public for a variety of uses compatible with basic wildlife management purposes.

In particular, the Fish and Wildlife Service welcomes youngsters to refuge lands so that as many as possible may get to know nature firsthand and develop an early understanding of wildlife, one that will stay with them throughout their lives and enhance their appreciation of the world.

To help accomplish this, the Service reaches out to educators with a teach-the-teachers approach. Get them "into" wildlife and they'll bring the kids along. When youngsters come to the refuges, which serve as outdoor classrooms, they're encouraged to get their feet wet and hands dirty. They learn about the ecology of a marsh by being in physical contact with its waters, soil and vegetation and with its waterfowl when they have an opportunity to participate in the Service's band-

ing program. Physical involvement like this—seeing, hearing, smelling, and touching the wildlife scene—leaves young people with lasting values. Similarly, on many refuges, young hunter programs impart a sportsman's ethic to youngsters at a crucial formative age.

For other visitors, the Service has plotted many self-guiding wildlife drives and walks. Booklets and signs interpret natural features of the refuges such as trees and other vegetation and glacial and geological formations. They provide wildlife information—perhaps that the ducks feeding in a salt marsh flew in from the northern reaches of Canada, or that the marsh also sustains a wide variety of other wildlife. Visitor centers at many refuges provide detailed information and present slide shows and films that tell about wildlife and habitat management and how the Service promotes the welfare of endangered species.

So, the Fish and Wildlife Service watches over wild inhabitants of refuges and at the same time seeks to provide visitors with quality outdoor experiences which have lasting value.

It's not all as easy as it may seem. Is a quality outdoor experience possible when traffic is bumper-to-bumper on a migratory bird refuge, or when fishermen want to put 300 boats on a stretch of river that reasonably accommodates only 50 boats?

Neither would qualify as a quality experience. But think about it. And turn the problem around. How would you feel if yours was the 51st boat and a closed gate blocked your route because more boats on the river would disturb the balance between wildlife and man?

In the years to come, answers to such questions may change from time to time as the Fish and Wildlife Service seeks a balanced, reasonable manner to provide Americans enjoyment of their wildlife heritage.



Children and adults take to the outdoors with equal enthusiasm, but a fine line must be drawn between people and wildlife to assure preservation of wildlife refuges. More than 350 National Wildlife Refuges are open to the public for a variety of uses that are compatible with basic wildlife management purposes.



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Desert Lands Serve Many Needs

By Jerry Harrell

Once an inhospitable wasteland to early explorers and settlers, the California Desert now is a recreational mecca for millions of Americans. The paradox is not yet fully understood, even by Federal agencies attempting to manage those arid lands.

On winter week-ends a steady stream of traffic fans out from Los Angeles and San Diego to remote desert canyons, sand dunes, and rugged mountain ranges. The people are geared for leisure in a still barren and often harsh environment. They come with water, food, chemical toilets, emergency equipment, and rugged off-road vehicles. Their numbers have more than doubled in five years.

In 1968 the Department of the Interior's Bureau of Land Management took a closer look at what was

occurring on the public's 12 million acres of desert lands. An intensive study was conducted in cooperation with the National Park Service. Results of the study merited the attention of Congressional leaders and leading national publications, including *Reader's Digest*, *Time*, and *The New York Times*. Legislation was since introduced to establish a California Desert National Conservation Area.

On the surface, the attractions that draw people are freedom and space, the opportunity to recreate amid an array of resources unmatched anywhere else.

Geographically, the desert is a land of appealing variety. Soaring mountain ranges, often snow-capped, lace a diverse topography of high plateaus, basins, dry lake beds, sand dunes, and rolling hills. Hardy, specially adapted plants put on flowering displays so impressive that sightseers and photographers plan special excursions to coincide with seasonal weather conditions that trigger the displays.

Wildlife population numbers ebb and flow with vegetation cycles. Desert bighorn sheep, tarantulas, coyotes, sidewinders, and a fascinating array of unique species beckon photographers, naturalists, and sightseers. Climatic conditions affect both wildlife and human use to which it caters.

Summer temperatures sometimes climb above 120 degrees and less than 10 inches of rain fall annually in the desert. Often there are prolonged periods when not a drop relieves the scorching dryness. When it does come, it may be as a thunderstorm, brief, violent, and yielding heavy runoff waters of tremendous force. These are the flash floods that sweep away vegetation, soil, and any human improvements that might be in the way.

The soils are quite shallow, and are underlain by 50 different minerals that annually yield nearly \$200 million to the national economy. Abandoned mine shafts dot the landscape, posing additional threats to the unwary. These and other haz-

*"Recreation is no longer simply having fun."
Rather, it involves "the kind of America we have,
and want to have, and the kind of people
we are and are likely to become."*

—Laurance S. Rockefeller

ards contribute to the annual toll of more than 170 deaths and 1,400 serious injuries occurring on public lands in the desert.

These unfortunate mishaps stem largely from the mass of recreationists who generate more than 12 million "visitor use days" per year. In 1968, when use was first studied, there was less than half that much use. Since then, BLM began a second phase to aid the recreating public and to protect the natural, cultural, and historic values they come to enjoy. It is a two-pronged phase, consisting of interim critical management and preparation of a comprehensive long-range plan for development, use, and protection of desert resources.

The principal elements of interim critical management include hazard reduction, a desert ranger force to assist and manage visitors, and a program of interpretation and education. One innovation to be used is a network of manned desert "way stations." In concept, these mini-visitor centers are based on

rest stop structures historically used on the old trails by travelers who wanted only to get out of the desert. Now they want to get into it.

Their reasons for coming include off-road vehicle use, rockhounding, sightseeing, camping, hunting, and myriad other uses. Of these, it is the use of off-road vehicles that generates most of the enjoyment,

most of the accidents, most of the economic spin-off, and most of the controversy. More than 70 percent of the 12 million visitor use days involve vehicles ranging from dune buggies to home-made gyrocopters to sand sailing rigs.

Concurrent with the California Desert Study, BLM's California State Office started work on an ap-



proach to off-road vehicle (ORV) management. In response to a resolution of the California State Multiple Use Advisory Board to BLM, the State Director established an ad hoc Off-Road Vehicle Advisory Council (ORVAC) to assist the Bureau in developing guidelines for managing off-road vehicle use of National Resource Lands.

The committee represented the whole spectrum of uses and interests: conservation, wildlife, local law enforcement, livestock, preservationists, and off-roaders. The management framework developed by ORVAC and published by BLM

Act being considered by Congress in 1974.

BLM has also developed an interim critical management program for recreation vehicle use of the California Desert. This program includes widespread public participation, such as open house meetings in desert communities; mobile exhibit and fact-finding units which toured both desert cities and key points in the Southern California metropolitan area; public meetings; and field trips.

The interim critical management program designated National Resource Lands as open, closed, or

stantial degree of management of organized events under its special land use permit procedures, which require sponsors to obtain a permit if organized events involve 25 or more vehicles competing on a defined course. Requirements for permits include insurance, bonding, provision for health and safety, and a recreation use fee. These events total more than 150 a year and involve some 65,000 participants and 200,000 spectators.

Legal action that followed in the wake of the BLM program was a measure of both the intensity of feeling and of the conflicting uses



Start of a cross-country off-road vehicle competition in California desert. Events attract as many as 25,000 spectators on winter weekends. BLM's off-road vehicle regulations require issuance of special land use permits, providing protection for both user and resource.

in a report entitled "Operation ORVAC," plowed new ground in a segment of recreation management that was in its infancy. ORVAC's work is reflected in President Nixon's Executive Order 11644, which mandated a program of management for off-road vehicles on all Federal lands, and in the Department of the Interior's Task Force Report on Off-Road Recreational Vehicles.

ORVAC proposed designations of three types of area: open use, restricted use, and nonuse of closed areas. Two types of uses were recognized: individual or nonorganized groups and structured events such as races, rallies, and sports events. Permits were recommended for organized events. Other recommendations included law enforcement authority for BLM through the nucleus of a desert ranger force. Enforcement of Interior regulations would be provided through BLM's Organic

in one of several restricted categories, such as limiting vehicle travel to existing or designated roads and trails. Competitive courses were identified, and a number of areas were earmarked for "special design," limiting travel to designated roads and trails pending completion of special management plans. Ad hoc fact finding groups, including conservationists and users, assisted in developing plans for these areas.

BLM's Riverside and Bakersfield Desert Districts and small Desert Planning Staff concentrated their efforts on developing the management program.

A principal thrust of the interim critical management program was to reach unorganized users—the family group, friends, or individuals who go to the desert for the weekend and ride motorcycles, dune buggies or 4-wheel vehicles.

BLM already had achieved a sub-

of the desert. Opposing sides filed suits against the program. Recreationists led by the California Association of 4-Wheel Drive Clubs sought to block implementation of the program. Environmentalists, led by the Environmental Defense Fund and Sierra Club, sought tighter controls on vehicle use and full environmental impact statements on individual designated "open" areas.

Beneath the furor, planning, and overriding problems of resource and people management, psychological and social principles related to human need had to be considered. Mankind is perpetually on a search for completeness and a measure of happiness. What is lacking in jobs, family life, and spiritual life most often is sought in leisure. Recreation studies often fail to derive that fact. When asked, "Why do you come to the desert?" most users answer, "Just to get away

from it all." A shallow question . . . a shallow response.

What they are there for often can be traced to one or more of these needs: self-esteem, use of sensory and physical capabilities, knowledge, creativity, distraction, companionship, and spirituality.

They find self-esteem in motorcycle competition, in braving the elements triumphantly, in enduring voluntary deprivation of personal comfort, in doing good for others with whom they share the outdoors.

They search out the scientific, historical, and natural wonders prevalent in the desert. They build unique vehicles, make jewelry of once rough stones, and paint landscapes.

They enjoy traveling in groups, sharing campfires, meeting for a tour, a rally, or a race. They forget the work-a-day world, commuting, stifling crowds, noise, and everyday problems. They find uniqueness, beauty, mystery, and danger.

The desert has many values: rich mineral deposits, grazing lands, agriculture, power sites for energy-hungry Southern California, and room for new urban areas. But many believe the social values of the California Desert as a leisure place for harried urban man may be its highest value. BLM is working to preserve and enhance this great recreational value through the California Desert Program.

In dedicating the Recreation Lands of the California Desert in 1972, Secretary of the Interior Morton said: "Our dedication of these 19 areas today is surely a conservation landmark in and of itself, but there are 448 million more acres out there that deserve the same skillful planning and management principles. May our work here in the California Desert be a rung in the ladder which we shall climb to reach that goal."



Wind-sculptured Trona Pinnacles. Secretary Morton tries out a dune buggy at National Desert Recreation Lands ceremony. The desert becomes a winter weekend home for thousands of outdoor enthusiasts. A sand sailor finds solitude and tranquillity in windswept vistas.







PEOPLE IN PROGRESS





Territories' Patterns of Change

By Harmon Kallman

For all their tropical beauty, the island territories under United States administration are not rich in tangible natural resources.

Their future prosperity will depend on the conservation and balanced development of two fragile natural resources: the fish in the

ocean surrounding many of the islands, as the basis of a fishing industry, and the natural beauty of the islands themselves to support a growing visitor industry.

Encouraging territorial progress is one of the least noticed but most interesting responsibilities of the Department of the Interior, through its small but active Office of Territorial Affairs, which reports directly to the Secretary.

Progress is not measured in material things alone. An essential in-

gradient is the spirit of the people.

As the United States geared up for its 200th birthday celebration, these territories—American Samoa, Guam, the Virgin Islands, and the Trust Territory of the Pacific Islands (also known as Micronesia)—moved toward greater local control of their affairs.

They, too, faced critical choices. With political autonomy comes less Federal involvement, and to that extent, less direct economic and social aid in the years ahead. The



people understood; they signaled their readiness.

In an historic "Message to Micronesia," Secretary of the Interior Rogers C. B. Morton in January

Typical of the beauty in the Territories is Lime Tree Beach on St. Thomas in the U.S. Virgin Islands.

A Parade of Territories



The Virgin Islands

Virgin Islanders love to dance and "tramp," and Carnival time on St. Thomas and the Christmas Festival on St. Croix provide opportunities for that kind of fun and relaxation. (Left top, lower right).

Hundreds of Virgin Islanders are trained as skilled workers in the Islands' 15 watch assembly plants. (Lower left). Millions of gallons of seawater are converted to fresh water daily, giving Islands greater ability to grow and prosper. (Top right). Natives and visitors alike enjoy one of the Islands' best drinks—coconut juice. (Above left).

1974 announced United States support for a constitutional convention that would lead to self-government for the Trust Territory of the Pacific Islands. The Trust Territory has been administered by the United States under a trusteeship agreement with the United Nations since 1947.

Negotiations continued during the year with encouraging results toward agreement on the details of

free association status for the Trust Territory, with the United States managing defense and foreign affairs, and the Micronesians completely in control of internal matters.

Negotiations are being conducted by a joint committee on future status of the Congress of Micronesia (highest legislative body of the Trust Territory) and a U.S. team headed by Dr. Franklin Haydn

Williams, the President's Personal Representative for Micronesian Status Negotiations.

The Trust Territory consists of three major island groups—the Marshalls, Carolines, and Marianas. A number of islands in each of the chains were scarred by major World War II air, sea, and land battles between U.S. and Japanese forces.

While formal discussions with the Congress of Micronesia pro-



Guam

Guam has breathtaking views—tropical beaches, rugged hills, and sweeping valleys. Top left, twilight on Guam's coast; top right, surfing at Talofofu Bay, a growing way of life for Guam's young people; lower left, senior citizens working in arts and crafts; lower middle, Guam Kakuei Hotel, nearing completion in

1974; lower right, Guam's dressmaking industry utilizes local color and native design; and Chamorro youngsters enjoy a day at the beach (right, bottom).

ceeded, negotiations were conducted on a separate track by Ambassador Williams' team with a commission representing the Trust Territory's Marianas District.

The people of the Marianas District (or Northern Marianas), most of whom live on the islands of Saipan, Rota and Tinian, have shown a strong interest in becoming a permanent part of the United States almost since the beginning of the Trusteeship in 1947.

After much discussion and several public referenda, the leadership of the Northern Marianas requested the U.S. to hold special future political status negotiations with them separate from the rest of the Trust Territory. These negotiations commenced late in 1972 and have progressed quickly, especially in the areas of future Federal assistance and planning for a mutually desired multi-service military base on Tinian. It is hoped that remain-

ing technical matters in the negotiations, which establish the basis for a Commonwealth of the Northern Marianas in permanent union with the United States, will be completed by the end of 1974.

In his January 1974 message, Secretary Morton opened the doors to more change by lifting restrictions over foreign investment in the Trust Territory. Individual and commercial investors "from any of the world's community of nations" will



American Samoa

The Pago Americana Hotel in Pago Pago, American Samoa, (left top) utilized modern adaptation of traditional Samoan architecture. Rainmaker Mountain

is in background. A striking sunrise from a beach on the main island of Tutuila is shown at right top and a view of Pago Pago's business district is shown at lower left. Western High School in Leone, Tutuila, (lower right) shows modern school buildings adapted from traditional Samoan Round House or "Fale."

be permitted to apply for business permits in Micronesia.

The people of the Virgin Islands and Guam elected their own governors for the first time in 1970. Two years later each elected a non-voting delegate to Congress for the first time. In 1974 the people of each of these territories had their first opportunity to vote at the same time on candidates for both governor (a 4-year term) and delegate (a

2-year term). The only appointed Interior official in the governments of Guam and the Virgin Islands is the Federal comptroller—an indication of the degree to which both territories have moved toward full internal autonomy. Each territory has long had an active locally-elected legislature.

Control of submerged lands of Guam, the Virgin Islands and American Samoa, historically another

U.S. responsibility, appeared on its way to being turned over to the three territorial governments. Legislation to effect the transfer was before Congress with the strong support of the Nixon Administration.

Some other highlights of the year:

- Rehabilitation of Bikini Atoll is in progress with the hope that the original inhabitants and their families can return in the near fu-



Moen High School (upper left), located in a lush tropical setting on Truk's Moen Island, operates for pupils at the junior high level. Moen's tourist motel (upper right) is located in a setting of graceful trees and blue waters nearby. At lower left a young boy washes clothes in one of Ponape's fresh-water

The Trust Territory

streams and, at lower right, villagers gather for a meeting on one of Yap's outer islands.

ture. Bikini, whose name is known worldwide in quite a different context, was the scene of more than 20 nuclear weapons tests from 1946 to 1958. The Bikini people who were relocated to the island of Kili have always wanted to go home, but nuclear decontamination and the re-growth of life-sustaining coconut trees and other crops have required time.

- A U.S. National Wildlife Ref-

uge, the first in any of the Pacific territories, was established on tiny Rose Atoll, a part of the territory of American Samoa, to preserve its sea turtles and more than a dozen sea species, and for scientific study. Director Lynn Greenwalt of the U.S. Fish and Wildlife Service, an Interior Department Agency, credited the Samoan people's interest in preserving the 18-acre atoll in its unspoiled condition.

- Preliminary talks were under way involving Interior, Department of Defense, and the people of Saipan, toward establishment of a historical park on Saipan honoring those who died during the struggle for control of Micronesia during World War II. Studies were conducted toward that end by Interior's Bureau of Outdoor Recreation.

Young People Spur Conservation

By Kathy Wood Loveless

Throughout the mountains, forests, and plains of America, young men and women are constructing waterfowl fences, improving campgrounds, pruning trees, and stabilizing sand dunes. Work that one could assume would take many husky men several months to complete is being accomplished by these young people in just eight weeks.

The program is the Youth Conservation Corps, more commonly

referred to as the YCC program. Under the sponsorship of the Departments of Interior and Agriculture, the YCC program has expanded from a small pilot project in 1970 to a program of 178 camps this year, employing 5,500 youths.

By utilizing the talents of young men and women during the summer months, Interior and Agriculture are able to complete many projects. While these Departments are having manual work accomplished, the YCC program provides the youth an opportunity to earn money, to further their education, and to gain an understanding and appreciation of the Nation's heritage and natural environment.

The camps are on lands managed by Interior's Bureau of Reclamation, Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlife Service, and the National Park Service; and by Agriculture's Forest Service.

For the first time since its inception, the YCC program was expanded this year to include State-operated camps. Ten million dollars were available for the 1974 program, an increase of \$6.5 million and almost triple the amount for previous years. Thirty percent of the money went to States as matching grants to conduct YCC projects on non-Federal public lands and waters. The State YCC projects will



be comparable in nature to the Federal YCC camps.

An additional benefit of the program is that in many camps for every dollar invested, the Federal Government received more than a dollar back in appraised value of the program accomplishments.

YCC is comprised of youths, between 15 and 18 years old, who are permanent residents of the United States, its territories, or possessions. The girls work right alongside the boys and seldom do either complain about the hard work. All

Young men and women work side-by-side to conserve our nation's resources.



participants must be recommended by a school official, or other adult familiar with the student's interest in conservation.

The camps are residential and nonresidential; some are coeducational, while others are all female, or all male. Residential camps house from 24 to 50 enrollees. Facilities range from tents and rough bunkhouses, to large barracks-type buildings and college dormitories. In the past, some groups have even occupied remote ranger stations.

Nonresidential camps enable local youths to work on conservation projects during the day and commute home at night. Most camps last about eight weeks. Youths who participated in the program this year received food and lodging at the residential camps and were paid about \$300 for the season. Those who participated in the nonresidential program received a slightly higher rate of pay, in lieu of room and board. Upon learning that Corps members would actually be paid for their work, one youth commented, "You mean we get paid for all that fun?"

What that young man referred to as fun is more often described by adults as hard work. Stream banks were cleared, trails were cut, fish hatcheries were tended, park facilities were constructed, even experimental nests were prepared for rabbits who had lost their homes when they caved in.

Governor H. Aker, Director, Office of Manpower Training and Youth Activities, Department of the Interior, said of the young workers: "They accomplished far more work than we had ever anticipated. Equally important, they worked as a team, even though they were from varied cultural, racial, ethnic, and economic backgrounds."

All work projects are oriented and executed to give the Corps members an understanding of *what* they are doing, *why* they are doing it, and *how* it is to be accomplished. They also learn the part their





Learning to become one with nature is not necessarily a goal of the YCC program, but often is a by-product. YCC members work with the soil and learn about environmental needs and offerings. They learn to survive in the wilds, construct fences, and restore artifacts. But, most importantly, they learn that natural resources are finite and that our survival is dependent on a healthy environment.



project will play in the overall plan for the area. The effectiveness was exemplified by the comment made by one young woman, "I'm now more conscious of the pollution and conservation problems facing us today."

YCC participants are given the opportunity to accept all of the responsibility they can assume. They are expected to participate in camp operations, including the planning and execution of work projects. There is plenty of discipline at the camps, but for the most part it is self-discipline.

An important part of the program is learning to respect safety rules. Each day these young people are confronted with various potential hazards. To avoid these hazards, a continuing emphasis is placed on training and an awareness of safety through such meetings as "tail-gate sessions" held before work crews begin a project.

Not only do the youths receive experience and pay from this program, but many also receive academic credit. High school credit is given to enrollees who have set up a course of study relevant to the camp program prior to entering the camp. And a limited number of colleges grant credit to Corps members.

Each year as YCC camps open their doors to youths, they work to promote a three-fold goal: (1) to work on conservation projects needed to improve the quality of public land and water areas; (2) to employ our Nation's youth for the summer; and (3) to build a reserve of trained young citizens, knowledgeable of their country's irreplaceable natural and historical resources, and of their own place in the ecological system.

What better way than this could exist to utilize the limitless energies of American youth?

Johnny's Legions Grow Stronger

By Mark Guidry

"The times," according to Bob Dylan, "they are a changing." While Mr. Dylan addressed this observation to other phenomena, it applies equally well to the common interpretation of the word "environment."

This view is confirmed for the Department of the Interior's Johnny Horizon staff through the daily exchange of information with a growing number of individuals, groups and sponsoring organizations that support the Johnny Horizon Program. More than 2,000 inquiries asking for information leaflets, action booklets, etc., are processed each day. Requests for information total around 10 million items per year. The tone of requests, together with feedback from some 7,500 sponsoring groups, tend to confirm the thought that most Americans are most concerned about their close-to-home environment. The trend also is reflected in the mix of activities pursued by local action groups.

Time was when many citizen groups felt the main contribution they could make to improving the environment was to clean up litter. Today's activities are more sophisticated and varied, as shown by the following examples:

- In Franklin Township, New Jersey, practically everyone turned out in a month-long campaign to pick up litter, remove abandoned cars, plant trees and flowers, collect glass and paper for recycling, clean up lakes and streams, and otherwise spruce up their community.

- Working with their local Parks and Recreation Department, 15 civic and environmental groups in Racine, Wisconsin, sponsored a Johnny Horizon benefit concert to raise money for a downtown mini-park.



Buses save energy so, why drive your car when you can get your own chauffeur?

- In increasing numbers, Americans are taking the bus, forming car pools, and riding bikes. Many have rediscovered walking.

- A citizen's group in Illinois helped turn a polluted stream into a scenic attraction.

- To tackle one of the solid waste disposal problems at its source, many groups are supporting legislation to abolish throw-away beverage containers. Consumers also are aiding by consciously choosing returnable containers over one-way cans and bottles.

Johnny Horizon program people often lead the way but, in other instances, they run to catch up. In common with the volunteer groups that are the backbone of the Johnny Horizon effort, the program is zeroing in on community beautification and improvement and is pushing to meet its Bicentennial goal—"Let's Clean Up America For Our 200th Birthday."

Harry Chapin makes music to build parks by.





*Bring 'em back alive!
Returnables can make many
round trips and still be as
good as when they started.*

*Kid power can make
things much brighter.*



Return of the Menominees—

By Mary Ellen Ayres

The first Menominee Indian demonstration in favor of restoration of the Federal trust relationship over their lands was spontaneous. It came, appropriately enough, on In-

dependence Day 1970. Menominee Indian men, women, and children gathered around the blue and white barge reminiscent of a Mississippi River showboat pulled up on the shores of what had been one of the Menominee lakes about 30 miles west of Green Bay, Wisconsin. From it, prospective non-Indian buyers had been viewing summer lakeshore homesites.

These were lakes in which Me-

nominee Indians had the right by treaty to fish in year round. They were Menominee lands that remained in Menominee hands after a much larger portion had been taken. They were also those that early Menominee leaders had recommended the tribe retain after it was offered Minnesota swampland in their place by the United States Government.

But that summer, homesites on



Land Menominee refused to relinquish. Far left, spring on a Menominee lake. Above, headquarters of DRUMS, the organization that worked to restore Menominee to Federal services. Left, Ada Deer, Chairperson, Menominee Restoration Committee. Below, the Menominee lumber mill, tribal lifeblood.



the lakes and from former tribal lands were being sold to non-Indians so that Menominee County—one of the newest and poorest counties in the Nation which includes what had been the Menominee Indian Reservation—would have a larger tax base.

Grassroots opposition to land sales sprang up on the shores of the lake that Fourth of July in 1970.

Although the Menominee Res-

toration Act did not become law until December 22, 1973, for practical purposes the experiment that began in 1953 with House Concurrent Resolution 108 which outlined a national termination policy and culminated with the approval of the Menominee termination plan in 1961, ended that Fourth of July.

This is the story told by Shirley Daly, a Menominee Indian who speaks with a cadence some think

typical of Menominee Indians. She was in the July 4th 1970 demonstration and is Executive Director of DRUMS, an acronym for Determination of Rights and Unity of Menominee Stockholders. She is also a member of the Menominee Restoration Committee.

DRUMS is the principal advocacy organization that enabled Menominee termination to be overturned by the 93rd Congress. Among its

goals have been *Menominee* participation in tribal affairs, restoration of Federal recognition, stopping of the sale of Menominee land, and building socially and economically sound programs that would not destroy the land and the culture of the Menominee. The organization was formed in the spring of 1970 by Menominees. Menominee Indians are proud that this group succeeded through the democratic and legislative process.

The coalescing of Menominee opinion on one holiday is in keeping with Menominee Indian tradition. The original Menominee system of government was a democracy, but one in which voting in the ordinary sense did not prevail. A council of chiefs carried out the major responsibilities of government. Tribal members were called together to express their opinions on important issues. When this happened, discussions continued as long as anyone had anything to say. After a consensus developed, a majority position was ratified unanimously.

Although the governmental tradition of the Menominee Indians is similar to that of other Indian groups, it is unusual in that the leadership and organizational ability of its members enabled it to sophisticatedly and successfully petition the United States Government to right what Menominee Indians considered a wrong. The Menominee victory came December 22, 1973, with passage of the Menominee Restoration Act.

A nine-member Menominee Restoration Committee was certified May 6, 1974, just 135 days after the Menominee Restoration Act was signed into law. The Act specifies that such a Committee be elected by the Menominee Indian Tribe of Wisconsin and that the Committee serve as the representative of the tribe until it adopts a constitution and bylaws under which a tribal council can be elected.

Members of this Committee are Ada Deer, Shirley Daly, Sarah Sku-

bitz, Sylvia Wilber, Carol Dodge, Jerry Grignon, Ben Miller, Robert Grignon, and Warren Kakwitch.

Buildings on land owned by Menominee Indians are frequently called upon for double duty so, not surprisingly, the first meeting of the Menominee Restoration Committee was held in the headquarters of DRUMS.

DRUMS headquarters, a well-constructed circular building with a wooden roof that peaks in the middle, was built as a culture center. Its twin, perhaps 30 feet away, was to have been a nature center, and now is a remedial school for Menominee Indian high school dropouts. The two were to have been the heart of a Menominee County



"Spare our lakes pollution, such as this," say the Menominee.

tourist complex—a vision of Menominee County leaders and their advisers.

But it is a mystery to Menominees like Shirley Daly and Ada Deer how the culture center and nature center would have helped Menominee Indians.

Nancy Oestreich Lurie, Curator of Anthropology of the Milwaukee Public Museum and a member of the faculty of the Department of Anthropology at the University of Wisconsin in Milwaukee, expressed similar doubts at hearings before the House of Representatives on Menominee restoration. In testimony, she said:

“. . . Legend Lake (the name given the development in which one large lake was to be formed by

dredging connecting links between seven Menominee lakes) embodies features that give pause to the applied anthropologist. To allow an invasion of 2,500 non-Menominee families who can afford prime recreation and retirement homesites is asking for social disaster in a community of perhaps 500 Indian families, over half of which are on some form of public assistance . . .

"The Legend Lake project has not created a significant number of new jobs for Menominees to date, and even if there are potential jobs in the construction of summer homes for those qualified in the building trades, it can only be a temporary boom until the houses are built. The future appears to

hold the dismal prospects of affluent whites taking advantage of a cheap Indian labor pool of domestics and handymen while enjoying a source of quaint entertainment when the Menominees 'take pride in their heritage' by annual powwows and similar galas."

The Menominee Restoration Act brings back the tribe's unique relationship with the Federal Government as a tribe under the Indian Reorganization Act; repeals the 1954 Act which terminated it; and reinstates the tribe to all rights and privileges it had under treaty and statute prior to termination. This includes the rights to services of the Bureau of Indian Affairs of the Department of the Interior.

Menominee lands will be returned

to trust status and be free from real property taxation, as are all Indian lands held in trust. This will save lands still in Menominee hands. The tribe has bought a large portion of the land sold to lakeshore developers but not yet developed. Because they were successful in stopping the sale of their lands, Menominee Indians will soon control the largest Indian reservation in the State of Wisconsin.

Under the 1954 Termination Act, the land of the Menominee Indians became Menominee County and the tribe's lumber mill and logging operation became a separate business—Menominee Enterprises, Inc. (MEI). Over 70 percent of those employed in Menominee County work in the MEI lumber industry.

Although the Menominee seemed prosperous in comparison to other Indian tribes at the time of termination, their resources were not adequate to finance a county form of government.

They were faced with new and heavy expenses, including taxes, utility costs, and land payments. The lumber industry could not give the Menominees enough jobs, and indeed not all of them wished or were trained to work within the lumbering industry.

No longer did they have their own hospital and health care.

"The only factor that prevented us from complete collapse was huge stopgap financial assistance the Federal and State Governments gave us," Ada Deer testified before the House of Representatives concerning Menominee restoration. "Since 1961 almost \$20 million in special Federal and State grants has been expended in Menominee County and since 1965 nearly \$1,500,000 has been received from the Office of Economic Opportunity. None of this attacked the basic cause of Menominee poverty."

Transfer of assets from MEI to the Secretary of the Interior is to be carried out under the laws of the State of Wisconsin subject to all valid existing rights others may

have in the assets. The Indians are called upon to develop a transfer plan and, according to Miss Deer, plan to continue their sophisticated methods of achieving workable solutions to Menominee problems.

Congress will get one more look at the terms under which the Menominee land and other assets are put back into trust status. Under provisions of the Menominee Restoration Act, the transfer plan will be submitted to Congress within one year from the date of enactment of the Act. If the House or Senate does not disapprove the plan within 60 days, it will take effect.

Tribal options include contracting to undertake activities often per-



Young Menominee drum outside the Menominee Community School, a remedial one for Indians who drop out of a nearby predominantly white high school.

formed by the Bureau of Indian Affairs. The Menominee Restoration Act enables the Menominee Restoration Committee to receive grants and to enter into contracts to accomplish the general purposes for which Federal funds are appropriated, a measure unique in the annals of Indian affairs. Actions taken under this authority can bind the Menominee Tribal Council—when elected—for up to six months from the time it takes office.

Menominee County is expected to remain after Menominee Indian land is returned to trust.

What will restoration of Federal services mean to Menominee Indians? Glen Miller is on the staff of DRUMS. He is a veteran of three

years in the Marine Corps during the Vietnam conflict and sees changes that could be made to help other young Indians in terms of education and law and order.

"Indians are being tried in nearby white courts that are not aware of Indian problems and attitudes. Menominee Indians are at a disadvantage," he points out. "The only jail available for Menominee Indians is also in a non-Indian community.

"Following termination, the Menominee Indians were forced to attend high school in a nearby white community. We felt that the faculty and white students had little understanding of Menominee values and ways of life. Indian families are gen-

erally very large and poor. I was expected to look after my younger brothers and sisters after school and do chores. I had no time and no place to do my homework. I fell behind, and was constantly truant. This is true of a great many Menominee high school students.

"Most Menominee young people are in the cities, largely in Milwaukee and Chicago. I stay because I don't like cities."

Then, looking across Wolf River, he said: "I think I'll go up to the Dells this weekend and throw my line in."

Monroe Weso, a full-blooded Indian, works with the Menominee Community School funded by private foundations and operated by

the Indian community. This school concerns itself with remedial efforts among young Menominee Indians who have dropped out of the high school operated by Public School District 8—a combined effort of Menominee County and nearby non-Indian Shawano County—that is located in the non-Indian community of Shawano.

In testimony before the House Interior and Insular Affairs Committee during restoration hearings Menominee educators charged that an alarmingly high dropout rate was the result of prejudicial conduct by the school district and the lack of effective control by Menominee County parents.

Weso helps young Menominees appreciate their own heritage. He



Indian loggers take training.

speaks the Menominee language fluently and is using the language to develop materials for young Menominees.

He is a master of information on Menominee language. For example, he explains that the Menominee word for "Frenchman" comes from the Menominee word for "sailboat" because the French came to Menominee country in sailboats on the lakes.

He went to a Bureau of Indian Affairs boarding school in Nebraska when he was young, where he lived with Oneidas and Winnebagos who, like himself, spoke only their own tongue. He and they learned, painstakingly, to communicate with one another and to speak English.

Delores Boyd is a director of the Headstart School at Keshena. Her husband is John Boyd, general

chairman of the Menominee Restoration Victory Celebration scheduled in the summer of 1974.

Delores Boyd is proud that her children are involved in community affairs. One daughter is a teacher and counselor in the Shawano High School, another is librarian for Menominee County, and a third is on the staff of Ripon College, Ripon, Wisc. "I want my children to have a good education so that they can meet the white man on his own terms. I have a good background in Menominee culture and I have tried to give that to my children. I try to give the children in Headstart this same combination. I do not believe people should equate being Indian with being uneducated."

Sylvia Wilber, Chairwoman of Menominee Enterprises, Inc., Board of Directors, was an active DRUMS member who campaigned for a position on the board of the corporation with zeal when DRUMS began to seek electoral means to make its voice heard. Mother of ten children, she was elected to the chairmanship of MEI by the members of the board because she showed business acumen and dedication. With strong zest, she directs this business upon which so many Menominee depend.

She headed the effort to bring American Indian Management Institute of Albuquerque, made up of Indians and non-Indians, to Menominee County to restructure the MEI organization. The consulting group held seminars with leaders of the lumbering company over a week's period of time and the result was a complete reorganization.

Mrs. Wilber feels the lumber mill, mainstay of the Menominee economy, must make changes. "We are picking our priorities very carefully. Fire protection is high on the list," she says, adding that "standardization of mill equipment must also come."

She admits that financing is a major problem.

Ted Boyd, comptroller of Menominee Enterprises, Inc., who is now

attending the University of Wisconsin at Green Bay, represents a renewed interest among up-and-coming Menominee young adults toward taking responsibility for the direction of the group. He says he returned to Menominee County six years ago, and indicated that the mill needs a long-term modernization program.

Ben Miller, Chairman of the Menominee County Board of Supervisors and an employee of Menominee Enterprises mill, wants the best of two worlds from the changes that are now in process. He is on the Menominee Restoration Committee that is already discussing ways to bring this about.

"I say that, as chairman of the county and town boards, I have the ungratifying job of levying taxes against our people," he points out.

Miller adds that, prior to termination, the Menominee Tribe had the services of a Federal hospital at Keshena and a Federal medical clinic in the village of Neopit. Both were staffed with doctors and nurses and even provided employment for local Indians. Now the entire county has only a single county-sponsored clinic. He is working hard to insure that restoration will rectify this situation.

Perhaps Ada Deer sums up the hope of her people when she says: "The Menominee have struggled to save our land and our life as a people. At one time any Menominee could go to the lakes. We shared the land in common. We think restoration of Federal recognition will preserve our rights and lands and restore social services to us. But we wish Federal protection without Federal domination.

"We have worked long and hard to restore the Menominees to the roster of Federal tribes. We intend to continue to work to create our own future."

Menominee believe The Dells of Wolf River are best preserved by being in trust.

"A river is a treasure."

—Oliver Wendell Holmes



More Water For The Navajo Nation

By Harold J. Boyd

In parts of New Mexico, Arizona, and Utah a picturesque 15-million acre nation lives within a much larger nation. The smaller nation is the home of 140,000 native Americans—The Navajos.

The Navajo Nation, the largest, most-populous, and once most pitifully poverty-stricken reservation in the United States, is on the brink of the greatest development in its history—the completion of the Navajo Indian Irrigation project. To the Navajo Nation, the occasion might be reminiscent of the founding of our country 200 years ago.



Lake Navajo provides water for desert crops.

The spring of 1976 may come to mean to the Navajo people what the spring of 1776 meant to the founders of the United States. It will initiate a revolutionary economic movement opening up new horizons to the Navajos by beginning the transformation of a north-west New Mexico desert.

Cooperation between the Navajo Tribe and Federal, State, and local agencies, has brought an age-old dream a step nearer fulfillment. Fulfillment will come with delivery of water to the first 10,000 acres of the 110,630-acre Navajo Indian Irrigation project now being constructed by the Bureau of Reclamation.

Construction of the main canal

conveyance system began in 1964. The main canal, extending from Navajo Dam to the eastern edge of the project land, was under construction in 1974. Continuing construction will permit an additional 10,000 acres to be placed under irrigation each year until the total 110,630 acres are under irrigation by 1986.

The project will contribute to the progress of the Navajo people through orderly development of human and natural resources of the reservation. Irrigation of the 110,630-acre project will put to use the renewable natural resources of water, land, and climate. With the assistance of irrigation, these three elements may continue to yield their bounty, year after year.

Research conducted by New Mexico State University's San Juan Branch Agricultural Experiment Station has provided insight on the most productive crops for the area. Plans call for alfalfa, potatoes, and shelled corn to be planted on the first increment of land.

Employment and money from the production of irrigated crops will greatly assist the Navajo people in obtaining a position of self-sufficiency. Irrigation of project lands will be the catalyst to convert sagebrush and poor sheep pasture to green fields.

Full development of irrigated farming and related industries and services should produce a tremendous economic impact. Development of the land will provide increased employment opportunities and income potential for the Navajo people. Significance of the project is underlined when one realizes that the irrigated acreage in San Juan County, San Juan Basin, and the State of New Mexico will respectively increase by 440, 280, and 14 percent, respectively.

The project can thus help the Navajo people in pioneering a new era which could advance their prosperity late in this generation or early in the next.

Indian Assistance For Parklands

By Ben Moffett

Herb Yazhe is chief ranger at Canyon de Chelly National Monument, located in the red rock country of northeastern Arizona's high plateau near the center of the sprawling Navajo Reservation.

When visitors ask about the occupants of the ruins and hogans spread across the 131-square-mile monument, Yazhe is ready with an answer:

"The ruins were once multistoried dwellings occupied long ago by the ancestors of present day Pueblo Indians; the hogans are still in use. They are occupied by Navajos like me."

An Indian park ranger telling about Indian history?

The situation is not unusual in the National Park System where native Americans play an important role in the history of many areas and where some areas are on or near Indian reservations.

This is especially true west of the Mississippi where 90 percent of national parks, monuments and historic sites benefit from Indian contributions of one kind or another.

To take advantage of the unique contributions that Indians have to offer, the National Park Service is working to help Indians create jobs where they really want them—near their homes.

In the Southwest Region, an Indian Assistance Team headed by a Cherokee named William Fields works with Indians to provide recreational and cultural development and assist in the preservation of natural resources on the reservations. In all, 19 tribes have sought and received the help of Fields' team in reservation projects.

At Tesuque Pueblo in New Mexico, for instance, the Indian Assistance Team helped the Tesuques design a campground at Camel Rock. The

campground not only helps the Tesuques attract tourists, but the design also helps insure the preservation of the fragile Camel Rock, a famous landmark on the reservation.

And as a result of the efforts of the Indian Assistance Unit, a combination cultural center and office building has been constructed on the Kaibab-Paiute Reservation in northern Arizona. It is used to house the tribe's arts and crafts sales room and snack bar.

The National Park Service leases 1,939 square feet of office space and visitor use facilities for administration of Pipe Spring National Monument located within the reservation.

While the National Park Service is going to the reservations—when

miles of adobe walls in park areas across the Southwest.

Most of the ruins are on or near the lands of the Utes and Navajos.

"Many Indians are unhappy in the rushed, industrial life of the cities and prefer to remain close to their own people, their own language, laws and religion," Fields said.

Since the National Park Service often has jurisdiction in remote areas near the reservation, Indians find the parks attractive places to work.

In 1968 the National Park Service became involved in an Indian Summer Youth Program, funded by the Neighborhood Youth Corps, that has resulted in positions for many interested in National Park Service careers.

The enrollees work in interpretive



Navajo NPS members work on ruins at Canyon de Chelly.

asked by the tribe—to provide such assistance, Indians are also finding work at national parks in a variety of fields.

At Ocmulgee National Monument in Georgia, Creek Indians, encouraged by local citizens, have returned to their ancestral home from Oklahoma to participate in living history programs and operate a crafts shop.

There is now a permanent community of about 30 Indians at Ocmulgee.

At the National Park Service's Arizona Archeological Center headquartered in Tucson, ruins stabilization teams consisting mainly of Utes and Navajos work to preserve the

areas, manning information desks and giving guided tours and campfire programs. Others have been placed in administrative and maintenance areas.

Emma Herrera, an Oglala Sioux from South Dakota, is in charge of the Indian youth program in the Southwest which has resulted in placing over 850 enrollees in 46 park areas.

"We've received a tremendously positive reaction from all the parks that have participated in the program," Miss Herrera said.

One of the most enthusiastic responses came from Lionel Bienvenu, Superintendent at Pea Ridge National Military Park in Arkansas.



Establishment Day ceremony at Hubbell Trading Post.

"The Navajo youths were so energetic, so dynamic, and so interested in all the world around them that it sparked a learning experience between them and the people of Northwest Arkansas and Southern Missouri," Bienvenu said.

Training is another important aspect of the National Park Service's relationship with Indians.

At the Park Service's Horace Albright Training Academy at Grand Canyon, special courses for Indians in the management of campground and recreational resources are held.

Since 1972 Indians from more than 30 reservations have benefited from the training, which is conducted by several agencies and includes several Indian instructors.

The mutual interest of the Indian and the Park Service in each other has resulted in the promotion of several Indians to management positions.

One such Indian is Clarence Gorman, Superintendent of Aztec Ruins National Monument in New Mexico.

"If you're looking for an example of an Indian working for the National Park Service in an Indian area, you've come to the right place," Gorman said.

"This place was built centuries ago by the ancestors of the Pueblos. It was misnamed after the Aztecs. It is near the Navajo Reservation, I'm a Navajo and I have a Pawnee on my staff."

Vanice Hatathli works on a belt.





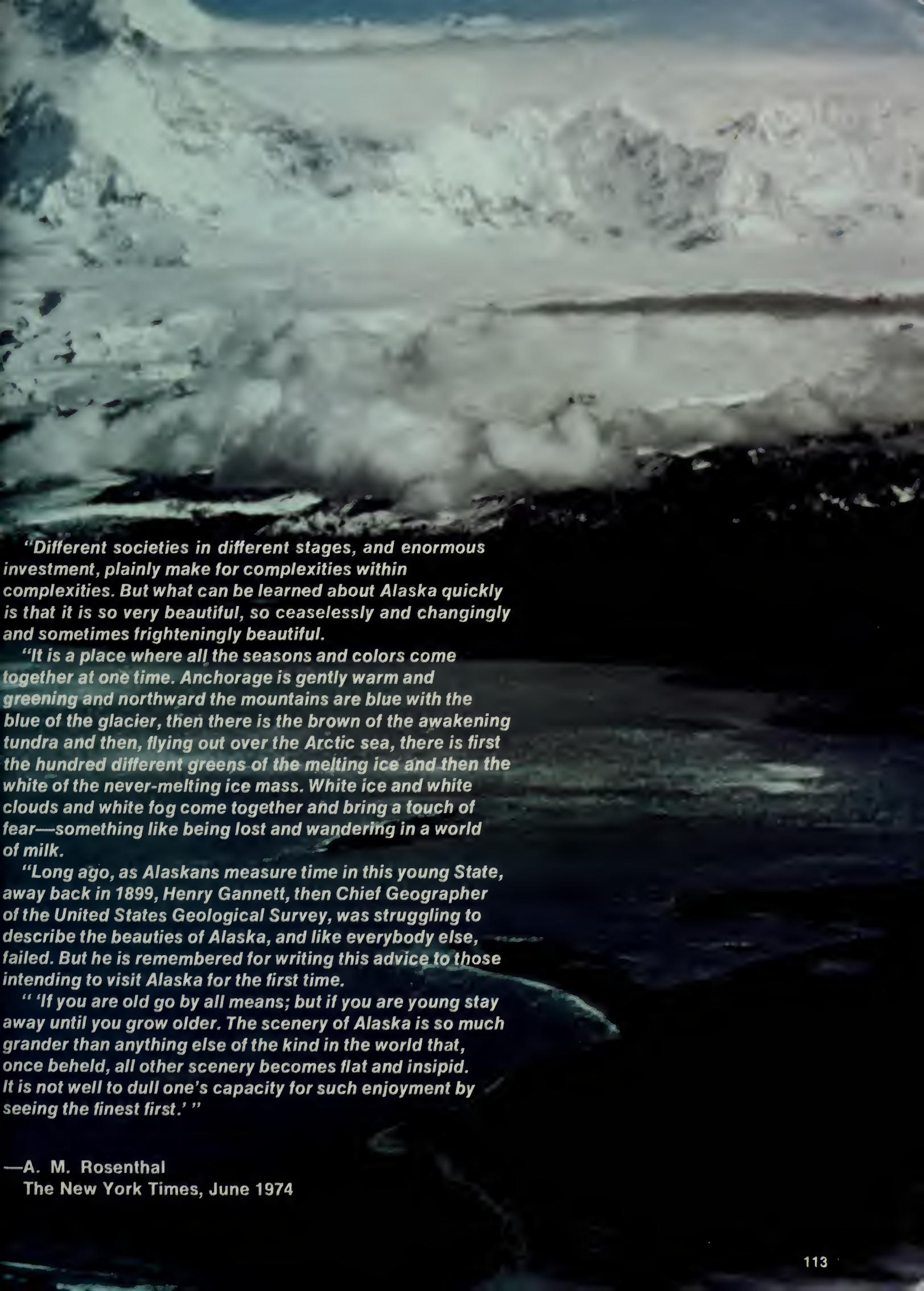
Putting It All Together-- THE ALASKA STORY





ALASKA





“Different societies in different stages, and enormous investment, plainly make for complexities within complexities. But what can be learned about Alaska quickly is that it is so very beautiful, so ceaselessly and changingly and sometimes frighteningly beautiful.

“It is a place where all the seasons and colors come together at one time. Anchorage is gently warm and greening and northward the mountains are blue with the blue of the glacier, then there is the brown of the awakening tundra and then, flying out over the Arctic sea, there is first the hundred different greens of the melting ice and then the white of the never-melting ice mass. White ice and white clouds and white fog come together and bring a touch of fear—something like being lost and wandering in a world of milk.

“Long ago, as Alaskans measure time in this young State, away back in 1899, Henry Gannett, then Chief Geographer of the United States Geological Survey, was struggling to describe the beauties of Alaska, and like everybody else, failed. But he is remembered for writing this advice to those intending to visit Alaska for the first time.

“ ‘If you are old go by all means; but if you are young stay away until you grow older. The scenery of Alaska is so much grander than anything else of the kind in the world that, once beheld, all other scenery becomes flat and insipid. It is not well to dull one’s capacity for such enjoyment by seeing the finest first.’ ”

—A. M. Rosenthal
The New York Times, June 1974



“The Great Land”

By Harmon Kallman, Elizabeth Gillette, John Vosburgh,
and the Staff of the Fish and Wildlife Service in Alaska

These are the most exciting times in the history of Alaska—“The Great Land”—endowed by nature with a magnificence that inspires awe even among Americans accustomed to bigness.

Everything about our 49th and largest State is on a gigantic scale, larger than life as most humans know it. Alaska is one-fifth the size of all the “lower 48” States combined. Its mountains, fjords, rivers, forests, glaciers, fish, wildlife, and minerals are so superlative words alone cannot describe them.

Yet, most of Alaska did not enter the mainstream of American life for more than 100 years after its



acquisition from Czarist Russia in 1867. Its remoteness, fantastic size, and severe climate helped keep it apart from the rest. Statehood did not come until 1959. Ten years later, more than 95 percent of Alaska's land area still was in Federal ownership. Native populations had long-standing claims to much of the land, but their claims were unresolved. Economic opportunity was limited. Even today, unemployment remains unusually high.

The catalyst that began to change Alaskan life was the discovery in 1968 of the largest oil field in North American history at Prudhoe Bay, one of the State's most remote

places on the frozen shores of the Arctic. In a few short years, problems that had log-jammed for decades began to fall into place. And Alaska came onstream, powerful and moving fast.

Today, Alaska is the place where:

- The oil from the Prudhoe Bay find is soon to make its way to market via the Trans-Alaska Pipeline, now under construction and due for completion in 1977. It is the largest privately financed construction project in the world to date. Because the pipeline crosses Federal lands, construction work is proceeding under the watchful eyes of Interior Department representa-

tives, charged with making certain it is built in accord with the most stringent environmental and technical stipulations ever imposed by the Government for use of a right-of-way.

- Two competing industry groups are seeking permits to build a natural gas pipeline linking Prudhoe Bay with markets in the "lower 48." One proposed route would cross into and through Canada; the other would generally parallel the oil pipeline to Alaska's south coast, where super-refrigerated tankers would carry the gas to the U.S. Pacific coast. Both routes would cross Interior-managed lands. Joint

Interior and Federal Power Commission environmental studies of the proposals are under way.

- More than 77,000 Eskimos, Indians, and Aleuts who descended from Alaska's original inhabitants are participating in the most comprehensive land-claims settlement ever made by the Government with a native population. Under the Alaska Native Claims Settlement Act of 1971 they will share in a cash award of \$962.5 million, plus a land transfer of more than 40 million acres from Federal control into ownership of more than 200 village corporations and 12 regional corporations. Villages were to make their final selections by December 18, 1974, third anniversary of the Act. Regional corporations have an additional year to make most of their selections.

- The State of Alaska is selecting 103 million acres of Federal lands within its boundaries for economic development, revenue, and public purposes, under the terms of its Statehood Act.

- Congress is considering the most extensive proposals ever made to expand the National Park System and the National Wildlife Refuge System to double the size of both. Secretary Morton in December 1973, following two years of intensive study, recommended 83.47 million acres—about 23 percent of Alaska's total land area—for inclusion in the National Park, Forest, Wildlife Refuge, and Wild and Scenic Rivers Systems.

Alaska has entered its most dynamic period of growth and change. With Federal land ownership giving way to a mixed pattern, an opportunity is opening for State, Native, and Federal cooperation, with major public participation. For the first time ever, a chance exists to apply knowledge about good land use that was not available when the other 49 States were settled.

Hindsight is 20-20, says the adage. Most of America grew without plan, as a uniquely free people interacted with a uniquely bountiful

continent. The results amazed the world. But as technology grew in quantum jumps and the population multiplied, we learned some bitter lessons. Nature's generosity does have limits. Blight, pollution, waste of resources, diminishing returns—all were abstract concepts to Americans a few generations ago. Today they are tangible.

With pioneering zeal, we felled forests and ruined the water and topsoil downstream. We filled marshes and called it progress, but did not notice until later that the fish and birds had died. We ripped and gouged the earth for minerals, then saw to our dismay that communities, even whole regions, had faltered and died as a consequence. Mushrooming suburbs slapped a garish plastic veneer over some of our finest landscapes, bulldozing cultural and historical treasures. Smog blanketed our proud cities, sharply limiting the air that once was the most plentiful of all resources.

To many thoughtful people the irony is that much of this waste may have been avoided without stifling national growth and material prosperity, had we taken inventory and planned the use of our land and resources first. Some places are ideally suited for industrial development, some for farming, some for logging and mining. The right choices at the right time could have made a vast difference, minimizing our reckless mistakes with the environment.

Good planning cannot be the work of governments alone. To be valid it must involve the people and their institutions, the business community, the universities, and citizen action groups. By airing each major proposal and subjecting it to public scrutiny, a consensus can be developed, and master plans adopted.

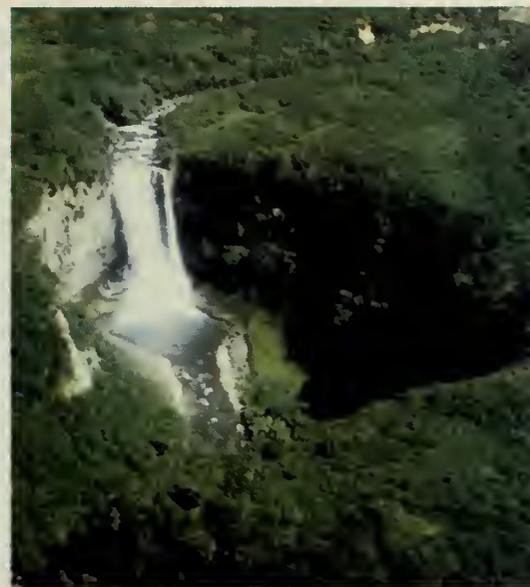
In Alaska there is still time to plan in this manner for the growth that is coming and the changes it will bring.

Congress recognized the oppor-



Alaska's Native peoples and their lifestyles are as colorful and fascinating as the landscapes they inhabit. Scenes like these give a brief kaleidoscope of the country's vigor and variety—from the young Eskimo athlete doing the high kick at the Point Hope Whale Festival to the ruggedly tranquil landscapes.

tunity by including in the Alaska Native Claims Settlement Act a provision for a new kind of public body—a Joint Federal-State Land Use Planning Commission for Alaska. Equally representing State and Federal interests, it is co-chaired by appointees of the President and of the Governor of Alaska. Since its inception in early 1972, the Commission has held detailed and lengthy public hearings throughout the State and has pursued an independent course, suggesting many changes in land classification and



use. This advisory body's life expires by law December 31, 1976, but it already has made its influence felt, and its legacy will survive, both in decisions adopted by governing bodies and in the precedents it has set.

Many basic land use questions remain to be answered. These are some of them:

- How to reconcile the newly fixed patterns of land ownership and management with Alaska Natives' pursuit of their livelihood. As one example, the North Slope's

Eskimos exist mainly by hunting and fishing for creatures whose migrations may vary from year to year. Those migrations may change further under the impact of newly developing industries. Tomorrow's land management plans must take such facts into account.

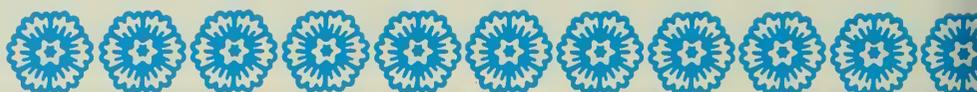
- How to give Alaska Natives full participation in newly emerging economic opportunities, while at the same time allowing them to preserve their unique cultural heritage.

- How to plan for development of much-needed oil, gas, other minerals, timber, and the wide array of Alaskan natural resources to minimize harmful and permanent damage to the living environment.

- How to decide where Alaska's new towns and cities will be located, and where the older ones will grow, so they will enhance and not degrade human life.

- How to locate and manage transportation corridors (for aircraft, vehicles, powerlines, and

WILDLIFE



pipelines) to make them both economically efficient and environmentally acceptable.

- How to make Alaska's matchless potential for national parks and recreation available to all, while preserving their uniqueness for future generations.

- How to protect Alaska's world-renowned fish and wildlife populations and make realistic allowance for Native subsistence lifestyles, for commercial use (example: the salmon), and for the growing pressure for sport hunting

and fishing as the population expands.

These and other decisions confront Alaska in the years immediately ahead. The way they are decided—their wisdom or folly—will determine Alaska's future.

All the accumulated wisdom on land use in the "lower 48" will not in itself suffice to meet Alaska's needs. For Alaska is a special case, requiring special adaptations, new approaches, new solutions.

Broadly stated policies must be translated into countless smaller

but crucial decisions. Consider that the U.S. Fish and Wildlife Service, a member of the Interior Department family of agencies, now manages about 19.8 million acres of Alaska's wildlife habitat in 18 National Wildlife Refuges. Consider also that about 35 Native villages within, or adjoining, these refuges are permitted to select as their own some of this refuge land—which also must be managed under refuge laws and regulations.

Lands to be chosen by Natives in these refuges includes prime habi-



© Wilbur M. Mills



Land of the great bear and vigilant eagle, land where ever-moving herds of caribou graze on tundra and moose take to the water to avoid mosquitoes, land of seals and countless flocks of wild waterfowl—this, and much more, is Alaska.

One such area is in the Yukon-Kuskokwim Delta of western Alaska, where the 2.75 million-acre Clarence Rhode National Wildlife Range is located. The cooperative agreement to be developed must help preserve a cultural heritage that dates back many centuries; it also must preserve a life-sustaining habitat for migratory birds that nest along prime coastal lowlands.

Everyone familiar with the area agrees there are communications problems on both sides. Traditional concepts differ, and language barriers exist. One response has been to employ several local residents as bilingual liaison officers, and train them in the use of such visual aids as videotape to explain the refuge concept to others.

Another plan is for a specialized training program to qualify Natives for employment as fish and wildlife resource managers. Openings for qualified people will increase as more such areas are designated by Congress and managed under complex local conditions.

Even with these means of communication, however, there must be developed a new breed of resource managers from the "lower 48" and other parts of Alaska who will listen with an understanding of Native needs and relate those needs to their superiors.

Apart from the communications issue are problems arising from the peculiar nature of Alaska itself. Wildlife is abundant in Alaska, but the density of wildlife populations is lower on a per-acre basis than in the rest of the United States; the dense gathering of birds, fish and mammals shown in many films and photographs is usually a seasonal phenomenon. Moreover, food supplies are limited by the severity of the climate. For example, grizzly bears, wolves, and caribou must range over vast distances to find the food they need. Large-scale intrusions on wildlife habitats by man would diminish wildlife populations. This explains why such seemingly

huge regions are proposed for safeguarding habitat for such wild creatures.

Also, most of the refuges provide nesting habitat for millions of migratory birds which give great pleasure and benefit to people throughout the world who never set foot on the area. Each autumn, birds disperse from Alaska's wetlands and travel their varied routes to brighten the lives of people over much of the globe.

To most Americans, the greatest drama about Alaska's new era of growth is in the story of the Trans-Alaska Pipeline. It was, to be sure, the focus of the most intense activity and study prior to its authorization. A Federal Task Force appointed by President Nixon began reviewing the proposal in early 1969. Under the leadership of Interior Department scientists, mostly from the U.S. Geological Survey, study teams subjected the proposal to a scrutiny never before matched.

While the studies progressed, design modifications were made by the oil companies to accommodate Interior's warnings about such potential dangers as thawing permafrost and seismic shock. Passage of the National Environmental Policy Act late in 1969 led to a court challenge that spanned the ensuing four years. Studies and public hearings continued during that time, and the Interior-led Task Force produced massive environmental and technical analyses. Stringent stipulations requiring sound design, construction and operation were developed at the same time. By January 1974, when Secretary Morton, acting on the strength of the new Pipeline Act, signed a right-of-way permit for the nearly 800-mile-long pipeline, the entire Federal establishment was fully ready to monitor every aspect of work in its north-south corridor from the Arctic to the Pacific. Work on the pipeline began in April 1974 by construction firms under contract with the Alyeska Pipeline Service Company.

at for wildlife. Most local residents will remain dependent on fish, wildlife, and plants for food. Obviously, then, refuge programs must make ample provision for the particular local lifestyle. How to provide for these needs becomes a question with many facets.

During 1974 the Fish and Wildlife Service was negotiating agreements for cooperative management of lands in and near five of the larger refuges in Alaska—agreements to make positive use of the Natives' knowledge of the country.

EXPLORING

Crowded out of the limelight during the early 1970's was another intensive effort by major elements of the Interior Department, mandated by the Alaska Native Claims Settlement Act—to help the Secretary determine which Alaskan lands should be retained in Federal ownership, and especially for the four systems of National Parks, Forests, Wildlife Refuges and Wild and Scenic Rivers. The activity was feverish during several periods in particular, because the 1971 Act contained two preliminary deadlines during 1972 and a final deadline in December 1973, second anniversary of the claims settlement law.

Teams of resource specialists from Interior's National Park Service, Fish and Wildlife Service, and Bureau of Outdoor Recreation under a cooperative effort headed by veteran park planner Theodor Swem fanned across the vastness of Alaska. By airplane and boat, on foot and using every other available means of travel, they at first roughed out the recommended boundaries, transmitted their recommendations, and then refined and re-refined them. Another team from the Department of Agriculture's Forest Service was working over some of the same terrain, and other areas equally remote.

Books will be written in future years about these explorers—for that is what many of them were, even though park and refuge planners had conducted less intensive studies on the ground over a span of many decades. Some of their choices were agonizingly difficult, under the pressures of time and Alaska's weather and terrain.

Among the roughest conditions, and keenest excitement, were those experienced by the small Bureau of Outdoor Recreation contingent whose job it was to assess which areas should be proposed for the National Wild and Scenic Rivers System. Here is an account of how they spent the 16 exciting months that began in May 1972:

"The first task we confronted,"

BOR team leader Jules Tileston said, "was determining the types of rivers that should be considered, then identifying from those the rivers with the most potential."

A list of 166 rivers extending 15,000 miles was compiled from recommendations of Federal and State agencies, conservation groups, and people familiar with Alaskan rivers.

Screening and aerial reconnaissance plus consideration of existing and potential riverbank ownership (some rivers were subject to further withdrawal under the Alaska Native Claims Settlement Act; some had fractured ownership patterns; others lay partially within the Alaska pipeline corridor) narrowed the list to 28 rivers on which detailed studies were conducted.

The BOR team had the benefit of aerial photos and maps compiled by the U.S. Geological Survey.

"But knowing that five people were responsible for scouting close to 30 rivers in two Arctic summers (totaling six months at the most) was as challenging and exciting to us as entire expeditions must have been to earlier explorers," said planner Noel Granzow.

Each team member was responsible for studying five or six rivers. They spent the long winter months in Anchorage libraries poring over maps and history books for information on the rivers they would soon float: What geologic formations and historical relics might one expect? Would the topography and soil composition pose unusual or perhaps dangerous navigation problems? What wildlife and vegetation might be found?

From readings and careful examinations of maps scaled one inch to the mile, the team prepared "dry lab" reports on the river environment, including as much detail as possible. At the same time, they determined the desired background of men and women whom they would take on the float trips. For example, a wildlife biologist would be vitally important on a river where information on wildlife or



Alaska is being explored in many ways by many kinds of people—in helicopters, in equipment designed to cross and test its fragile tundra, by oil rigs seeking more mineral wealth, and, by more traditional means, in canoes down the wild rivers, on foot, and by Eskimo dogsled.

fish was lacking. A historian could help determine the significance of Gold Rush relics and structures even older.

As a result, the river-running teams included experts from all involved elements of the Interior Department, from the State Government, and from local areas. Alaska Natives were among the participants.

The planners also completed Arctic survival training at Eielson Air Force Base. Emergencies in Alaska wilderness demand more



than the ordinary knowledge of first-aid. The team learned how to build shelters to weather nighttime temperatures of 50° below zero; snare rabbits for food; start fires with flint and steel; and signal for help. Once a hunter in distress, they were told, successfully signalled for help to a commercial jet pilot flying at 40,000 feet. Proper signalling could mean life or death.

Since nearly all study rivers were inaccessible by road, the field studies had to be planned entirely around the availability of planes

and canoes or rafts. The team used private planes and helicopters or Government craft where available. Canoes were rented or borrowed; at times, even the planners' personal canoes were used.

River study groups numbered four, six, or eight people. Pairs were mandatory for canoe and raft travel; at least two boats were considered necessary for safety reasons while four were the maximum for logistical reasons.

It sometimes took three plane trips to carry people, supplies, and

equipment to put-in points. When approaching a river, pilots flew low so the team could check water conditions and potential trouble spots.

At any given time, three teams were floating widely separated rivers, on the lookout for planes or helicopters that would carry them home from pre-arranged pick-up points. If a plane failed to show, or if a study team was delayed reaching the pick-up point, the results were sometimes hair-raising and could have meant disaster.

"The Ivishak River study had

gone smoothly for eight days," Noel Granzow recalled. "Four of us had even hiked inland in search of hot springs said to exist. We found the 'hot' springs, although the 48° water didn't seem too warm to us." Compared to winter temperature extremes of 50° or more below zero, the springs were considered warm.

"We arrived at the pick-up point July 4 and proceeded to wait for the plane due the next day. By afternoon of the Fourth, though, the temperature had dropped thirty degrees and a thick cloud cover at 400 feet settled in for several days," Granzow said.

"Our food supply—measured carefully to last the trip but no longer, as it added to the supply load flown in—was exhausted. The cold air, chill wind, and cloud cover provided little cheer.

"The next morning we ate grayling caught in the Ivishak and soup that we concocted by adding water to the food scraps stuck to a pot still unwashed from the day before," Granzow remembered. "Late that night the clouds lifted and the six of us were relieved to see a chopper come to get us."

The sheer vastness of Alaska, and the remote possibility that people on the ground would be sighted by pilots, pose survival problems for anyone who travels off established roads. It's imperative that someone know a traveller's intended route. Where possible, BOR planners in the field maintained radio contact with crews of the Bureau of Land Management, National Park Service, or Fish and Wildlife Service.

Between "put-ins" and "take-outs," days consisted of chilly white-water canoeing, evaluation of the river's wild and scenic qualities, extensive photography, and note-taking. Evenings were spent rewriting, updating, and expanding "dry-lab" reports. Twelve-hour work days, seven days a week, were the rule rather than exception.

"The experience was a once-in-

a-lifetime event," said planner Mike Wright. "We all knew it was a historically significant assignment to help determine Alaska's wild and scenic rivers."

Sometimes it was like paying a visit to the distant past. On one trip, Jules Tileston saw half-buried in a gravel bar a bison skull from the Pleistocene Age some 12,000 years ago. Hiking along the Togiak River, planner Pat Pourchot found the grave of an Eskimo with two rifles and a shotgun—badly rusted after many years outdoors—ceremoniously placed on top. Male Eskimos were buried in this way while cooking pots were placed on women's graves. All relics and artifacts are protected by the Antiquities Act and cannot be removed.

The planners also walked along part of the old Eagle-to-Valdez tele-



Above: Larry Asagroak, an Eskimo from Mary's Igloo on Seward Peninsula, inspects marker at an old grave site along the Kuzartrin River. Right: Part of the Arrigetch Peaks in proposed new Gates of the Arctic National Park.

graph line—built by the famous Army General Billy Mitchell while still a lieutenant at the turn of the century—and the abandoned Copper River and Northwestern Railroad line. Someday, both may be hiking trails.

No matter which river or riverbank the planners explored, they came to expect wildlife around every bend—wildlife not always welcomed.

All agree that the most abundant form of life in Alaska is the mosquito. Because Alaska has numerous stagnant ponds atop permafrost, mosquitoes flourish from spring thaw to first frost.

"We learned to make do with them," Mike Wright contended. "We probably ate them by the pound as they flew into our food. We habitually crawled into our tents at 7:00 p.m. to shut them out with protective netting. But I've never seen so many birds in my life. Some days we saw upwards of 40 species."

Timber wolves, moose, grizzly (brown) and black bear, beaver, Dall sheep, and caribou were sighted. Fishing for red and chum salmon, grayling, and northern pike was excellent. After one team completed the Fortymile River trip they learned it was the setting for Jack London's *Call of the Wild*.

"Tell me," planner Dave Dapkus asked his companions on the Noatak River trip, "what should I do if, alone and weaponless, I'm confronted by a bear?"

Wildlife biologist Dave Cline thought a moment, smiled, and said, "Look brave, but not defiant."

"It was the best advice I got," Dapkus said, describing three meetings with grizzly bears. "I'll say one thing, though, it's hard to take good photos of a grizzly 50 feet away, on hind legs, saying 'whoof'."

The planners ran glacial rivers including the Copper and Chitina. Water temperatures of about 34° made wet suits mandatory. Without them, if a boat upset you would have less than 1½ minutes before muscles contracted leaving you immobile. Even in nonglacial rivers the danger of hypothermia (where a combination of wet clothing and cold wind drains body heat, causing drowsiness and eventual death if not treated) was ever-present.

In Wood Canyon on the Copper River, a whirlpool as wide as 100 yards necessitated using river boats with 40 h.p. engines to avoid being caught in the drag. It is rumored that the whirlpool took the lives of

*“What is beautiful
is a joy
for all seasons . . .”*

—Oscar Wilde



40 people many years ago, all families relocating by waterway from McCarthy to Cordova after the local copper mine shut down in 1938.

The planners successfully skirted the whirlpool but, on another river, "sweepers"—fallen trees along the river—caused one canoe upset and near drowning. Fast rescue prevented a fatality.

The work of the BOR river team didn't stop at take-out points. Members attended public meetings all over the State, meetings in the smallest Native villages, to explain why the Federal Government was studying Alaska and the possible effects of findings and recommendations.

"We were not always warmly received," Granzow recalled. "The Natives were sometimes skeptical of explorers from the lower 48 States. They have good reason to be wary of what the future 'opening' of the Alaska frontier will mean to their small villages and present lifestyle.

"I remember one elderly gentleman summing up the fears of his village after having been told how the study efforts would ultimately help wildlife conservation. 'You come here from the big city,' he said, 'from Anchorage, to tell us about conservation. But what do you know about conservation? When you shoot a duck you eat the meat. When we shoot a duck we eat all the meat, the wings, the legs, and even the feet, and we then use the feathers. We use the whole damn duck. And you try to talk conservation to us?'"

At last the immediate job was done. The BOR river-runners, the biologists of the Fish and Wildlife Service, the planners of the National Park Service completed their reports, and after a most painstaking study and review, Secretary Morton made his recommendations to Congress in December 1973. These, in summary, are the areas he urged for inclusion in the Nation's permanent land and water estate:

NATIONAL PARK SYSTEM

Gates of the Arctic National Park: 8.36 million acres in the central Brooks Range of northern Alaska containing granite spires, rolling tundra, spruce-clad lowlands—the greatest remaining wilderness landscape in the United States.

Lake Clark National Park: Wildly diverse, its 2.61 million acres lie within easy distance of Anchorage on southern Alaska's Cook Inlet; it contains mountains, glaciers, spectacular waterfalls, deep valleys, and still smoking volcanoes.

Wrangell-St. Elias National Park: In southeastern Alaska, north of the Panhandle, its 8.64 million acres rank with Asia's Himalayas and the Canadian Rockies. Titanic Ice Age features include one glacier larger than Rhode Island.

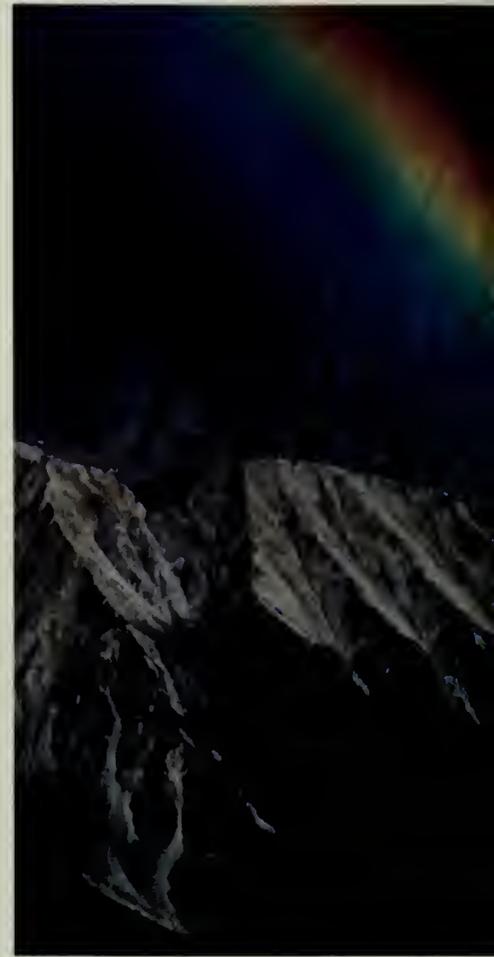
Katmai National Park: In southern Alaska, this would combine the existing 2.8-million-acre National Monument of the same name with 1.87 million acres of adjacent lands. Its salmon runs, Alaska brown (grizzly) bear and volcanoes are world-renowned.

Mount McKinley National Park enlargement: Adding 3.18 million acres to the existing 3.18 million acres, this would bring its size to 5.12 million acres and provide protection for all of the mountain massif and critical habitat for wolves and caribou.

Kobuk Valley National Monument: Some 1.85 million acres in Alaska's northwest, contain unique Arctic sand dunes, important archeological sites, and lands roamed by caribou, moose, black and grizzly bear, and wolves.

Cape Krusenstern National Monument: Adjoining the Chukchi Sea in northwest Alaska, its 350,000 acres of coastal plain may contain many answers to the riddles of the land bridge that once linked the Americas with Asia.

Aniakchak Caldera National Monument: A fantastic volcanic crater, six miles in diameter including a lake two miles wide and remark-



Interior's proposals to preserve matchless parts of Alaska span the Great Land—from rainbowed Orange Hill in the Wrangell Mountains, to Boreal Mountain at Gates of the Arctic, to this reach of the fabled Yukon near its meeting with a river called Charley. Their recreational and scientific potential is as enormous as their intangible value to a Nation always conscious of its wild heritage.

able wildlife, on the Alaska Peninsula south of Anchorage. It covers 440,000 acres.

Harding Icefield-Kenai Fjords National Monument: A 700-square-mile icecap with outflowing glaciers and a series of wildlife-rich coastal fjords and islands, not far from Anchorage, covering 300,000 acres.

Yukon-Charley National Rivers: Combines in its 1.97 million north-



east Alaska acres both human and natural history, along with unspoiled habitat for wolves, moose, and falcons, plus the entire Charley River drainage, an ecosystem largely undisturbed by modern man.

Chukchi-Imuruk National Reserve: 2.69 million coastal acres in northwest Alaska's Seward Peninsula, another remaining segment of the Bering land bridge, with wild-

life resources remarkable even in Alaska, and much geological significance. This would be jointly managed by the National Park Service and the Fish and Wildlife Service.

NATIONAL WILDLIFE REFUGE SYSTEM

Arctic National Wildlife Range expansion: Currently 8.9 million acres

in northeast Alaska, this largest unit in the System would be expanded by 3.76 million acres to further protect its amazing variety of life, from waterfowl to bears, eagles and caribou and 16 species of fish.

Three Yukon River Refuges: Yukon Flats, Koyukuk, and expansion of the refuges on the Yukon Delta would extend protection to wildlife across an additional 13.16 million

acres, the Nation's last pristine wetlands complexes, vital to at least 100 million nesting waterfowl, water birds, shorebirds, furbearers and other creatures.

Selawik National Wildlife Refuge: 1.4 million acres on the Arctic Circle with outstanding migratory bird habitat and essential caribou winter range, plus other mammals from grizzly bear to wolverines.

Alaska Coastal National Wildlife Refuges: 47,000 acres in five units along 1,500 miles of coast important to as many as 6 million seabirds plus sea lions, harbor seals, walruses, polar bears, sea otters,



Giving his views and receiving the opinions of others, Secretary Morton has traveled Alaska from far-north Barrow to the pipe-coating plant at Valdez.

and highly prized fish and shellfish.

Togiak National Wildlife Refuge: North of Bristol Bay in southwest Alaska, 2.74 million acres of coastal mountains supporting major runs of anadromous fish and providing important habitat to seabirds, waterfowl and 32 species of land mammals in addition to sea lions, walruses, seals.

Noatak National Arctic Range: This 7.59 million-acre area in northwest Alaska would be managed jointly by the Fish and Wildlife Service and the Bureau of Land Management for scientific study to increase knowledge of arctic ecosystems. This area is strategically important to caribou, bear, sheep, moose, wolves, wolverine, migratory birds, chum salmon, and Arctic char.

Iliamna National Resource Range: 2.85 million miles on Alaska Peninsula between Cook Inlet and Bristol Bay, west of Anchorage, including the greatest red salmon spawning grounds in the world; invaluable also for other salmon, trout, char, and pike, more than 100 bird species, furbearers, various large mammals, and the only known colony of freshwater seals in the Nation. It, too, would be managed jointly by F&WS and BLM.

NATIONAL FOREST SYSTEM

Porcupine National Forest: Ad-



joining Canadian border in east central Alaska, covering 5.5 million acres, 70 percent forested, with mineral potential.

Yukon-Kuskokwim National Forest: 7.3 million acres in central Alaska, more than 75 percent forested, with important wildlife resources.

Wrangell Mountains National Forest: In two units totaling 5.5 million acres, this proposed national forest has important copper and other minerals plus fish, wildlife, and scenic resources for multiple use management.

Chugach National Forest additions: 437,000 acres to be managed chiefly for scenic, recreation, and wilderness values.

Summarizing his recommendations, Secretary Morton declared:

"This is only the beginning as far as public participation is concerned." He pointed out that comments would be received and considered in preparation of final environmental impact statements on each proposal. He observed that both the Senate and House of Representatives would hold public hearings.

"We have attempted to reconcile many legitimate interests in making our proposals—environmental, recreational, economic, and social," Morton said. "We have tried to be judicious in considering the needs of the State of Alaska and its native peoples, while thinking of the interests of our Nation as a whole. We have tried to put our proposals in terms of whole ecological units.

"Inevitably, I have made decisions on which people may reasonably differ, and during the process of review, for many months to come, everyone will have ample opportunity to exchange views in the public forum."

In placing Alaskan affairs at the top of Interior's varied and complex agenda for action in the mid-1970's, Secretary Morton assigned extensive duties to many major elements of the Department to help him meet the tight, interlocking deadlines fixed in the Alaska Native Claims Settlement Act. In keeping with Interior's comprehensive responsibilities for the lands, native peoples, minerals and living resources of Alaska—and to make sure the work would be done with a minimum of red tape and delay—the Secretary created a blue-ribbon Alaska Task Force composed of his top policy-level officials Department-wide.

The intensive studies by the inter-bureau Alaska Planning Group on the "four systems" lands were one part of this all-out endeavor. Other parts have included the Bureau of Indian Affairs' role in determining native villages and allotment issues, and the work of the Bureau of Land Management in effecting land transfers and withdrawals, surveys, planning for transportation corridors, and numerous other duties.





Wildlands for Tomorrow

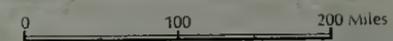
EXISTING LANDS WITHIN THE NATIONAL RESERVE SYSTEMS

- 1. Chugach National Forest
- 2. Tongass National Forest
- 3. Mount McKinley National Park
- 4. Glacier Bay National Monument
- 5. Katmai National Monument
- 6. Arctic National Wildlife Range
- 7. Kodiak National Wildlife Refuge
- 8. Aleutian Islands National Wildlife Refuge
- 9. Clarence Rhode National Wildlife Refuge
- 10. Bering Sea National Wildlife Refuge
- 11. Cape Nevenham National Wildlife Refuge
- 12. Nunivak National Wildlife Refuge
- 13. Izembek National Wildlife Refuge
- 14. Semidi National Wildlife Refuge
- 15. Simeonof National Wildlife Refuge
- 16. Kenai National Moose Range

PROPOSALS FOR THE FOUR NATIONAL SYSTEMS

	Millions of Acres
NATIONAL PARK SYSTEM:	
17. Gates of the Arctic National Park	8.36
18. Kobuk Valley National Monument	1.85
19. Cape Krusenstern National Monument	0.35
20. Aniakchak Caldera National Monument	0.44
21. Katmai National Park (additions to monument)	1.87
22. Harding Icefield-Kenai Fjords National Monument	0.30
23. Lake Clark National Park	2.61
24. Mount McKinley National Park (additions)	3.18
25. Wrangell-St. Elias National Park	8.64
26. Yukon-Charley National Rivers	1.97
27. Chukchi-Imuruk National Reserve	2.69
Subtotal	32.26
NATIONAL WILDLIFE REFUGE SYSTEM:	
28. Yukon Flats National Wildlife Refuge	3.59
29. Arctic National Wildlife Refuge (additions)	3.76
30. Koyukuk National Wildlife Refuge	4.43
31. Selawik National Wildlife Refuge	1.40
32. Coastal National Wildlife Refuge*	0.07
33. Yukon Delta National Wildlife Refuge	5.16
34. Togiak National Wildlife Refuge	2.74
35. Noatak National Arctic Range	7.59
36. Iliamna National Resource Range	2.85
Subtotal	31.59
NATIONAL FOREST SYSTEM:	
37. Porcupine National Forest	5.50
38. Yukon-Kuskokwim National Forest	7.30
39. Wrangell Mountains National Forest	5.50
40. Chugach National Forest (additions)	0.50
Subtotal	18.80
NATIONAL WILD AND SCENIC RIVER SYSTEM:	
41. Fortymile National Wild and Scenic River	0.32
42. Birch Creek National Wild River	0.20
43. Beaver Creek National Wild River	0.20
44. Unalakleet National Wild River	0.10
Subtotal	0.82
Total	83.47

Map by Francis & Shaw
 Source: U.S. Department of the Interior, March 1974



(Overleaf) Nabesna Glacier in Alaska's Wrangell Mountains was named in 1902 by F. C. Schrader of the U.S. Geological Survey.

**Alaska Rivers Proposed for Addition to the National
Wild and Scenic Rivers System**

<i>River</i>	<i>Miles</i>	<i>Classifi- cation</i>	<i>Proposed Unit</i>	<i>Agency to Manage</i>
Alagnak	47	Wild	Iliamna National Resource Range	FWS
Alatna	75	Wild	Gates of the Arctic National Park	NPS
Andreafsky	240	Wild	Yukon Delta NWR	FWS
Aniakchak	40	Wild	Aniakchak Caldera NM	NPS
Bremner	93	Wild	Wrangell Mountains NF	FS
Charley	191	Wild	Yukon-Charley National Rivers	NPS
Ivishak	65	Wild	Arctic NW Refuge	FWS
Kanektok	60	Wild	Togiak NWR	FWS
Killik	171	Wild	Gates of the Arctic National Park	NPS
Noatak*	330	Wild & Scenic	Noatak National Arctic Range	FWS
Nowitna	200	Scenic	Yukon-Kuskokwim NF	FS
Porcupine	114	Scenic	Porcupine NF	FS
Salmon	60	Wild	Kobuk Valley NM	NPS
Sheenjek	102	Wild	Porcupine NF	FS
Tinayguk North Fork of Koyukuk	195	Wild	Gates of the Arctic National Park	NPS
Wind	65	Wild	Arctic NW Refuge	FWS

* Portion within Gates of the Arctic National Park—NPS

Four Recommended Rivers Outside Other Proposed Units

Beaver Creek	135	Wild	BLM/FWS Management
Birch Creek	135	Wild	BLM Management
Fortymile River	375	W-S-R	BLM Management
Unalakleet River	60	Wild	BLM Management

(This table summarizes 20 rivers proposed for inclusion in National Wild and Scenic Rivers System. Sixteen rivers are located within proposed units of National Park, Refuge, or Forest Systems; four rivers located outside proposed new units would continue under BLM administration with one of these to be managed jointly by BLM and F&WS.)



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Photograph Identifications

Covers: *Front and back, inside back—Turquoise Lake, Lake Clark area, Alaska. Inside front—Offshore oil well, Louisiana. Contents pages—Twin Lakes, Alaska. Pages 10, 11—(top) Valley of 10,000 Smokes, Katmai National Monument, Alaska; Isle Royale National Lakeshore; Lower Twin Lake, Alaska; (bottom) Assateague Island National Seashore. Pages 36, 37—Imperial Valley, California, Wellhead Operations. Pages 112, 113—“Icy Bay,” Wrangell Mountains, Alaska. Pages 56, 57—Lake Clark Pass, Alaska. Page 129, State Ferry, Lynn Canal, Southeast Alaska. Pages 110, 111—Mt. Doonerak, Gates of the Arctic, Alaska. Pages 88, 89—YCC members, Johnny Horizon helpers, Eskimos, Indians, Islanders.*

Prepared by the
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For sale by the Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402 - Price \$4.95
Stock Number 2400-00808

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