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JULY 1976

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NATIONAL GEOGRAPHIC

THE NATIONAL GEOGRAPHIC MAGAZINE VOL. 116, NO. 1
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July 1976

WHEN I FIRST SAW the unique and splendid satellite portrait of the 48 states that accompanies this Bicentennial issue, I found myself absorbed in its detail—the clean-cut filigree of Lake Powell and the Grand Canyon; the undulating veins of the Missouri and Mississippi; the gentle folds of the Appalachians.

Yet there is an even larger picture, an even more compelling one. For this land of endless diversity, of city, forest, field, plain, river, and mountain, of complex ethnic differences, of goals and purposes as various as our people, is as the Founding Fathers had hoped: *E pluribus unum*—out of many, one.

Despite the grave unfinished business of society, we are a free and vital people. We can all recite the litany of our problems, from that of energy onward, but this seems a proper time to count our blessings, one of which has always been this magnificent land itself. We at the Geographic decided that The Land was at the heart of the matter in this July of 1976—the land and how our people have used, often abused, often cherished, often exploited, and often fought over it.

The table of contents to the right reveals how we developed this idea—from attitudes toward the land as it once was to a visionary's idea of "land" as it may exist in a future space colony. The unifying theme for the issue, as it is for the country, is the realization that the system, somehow, works, that great things are possible when men are free and determined to make them so.

Emerson once wrote that the true test of civilization was not the cities and crops it produced, but the kind of man it turned out. On this 200th anniversary of the United States, we can take a large measure of pride in the fact that we are still willing to labor for an ideal—that our land should be as rich and unique a heritage for our great-great-grandchildren as it has been for us.

Silvestro Brosuero

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COVER: *Living symbol of our land, a bald eagle, photographed by Jeff Foott.*

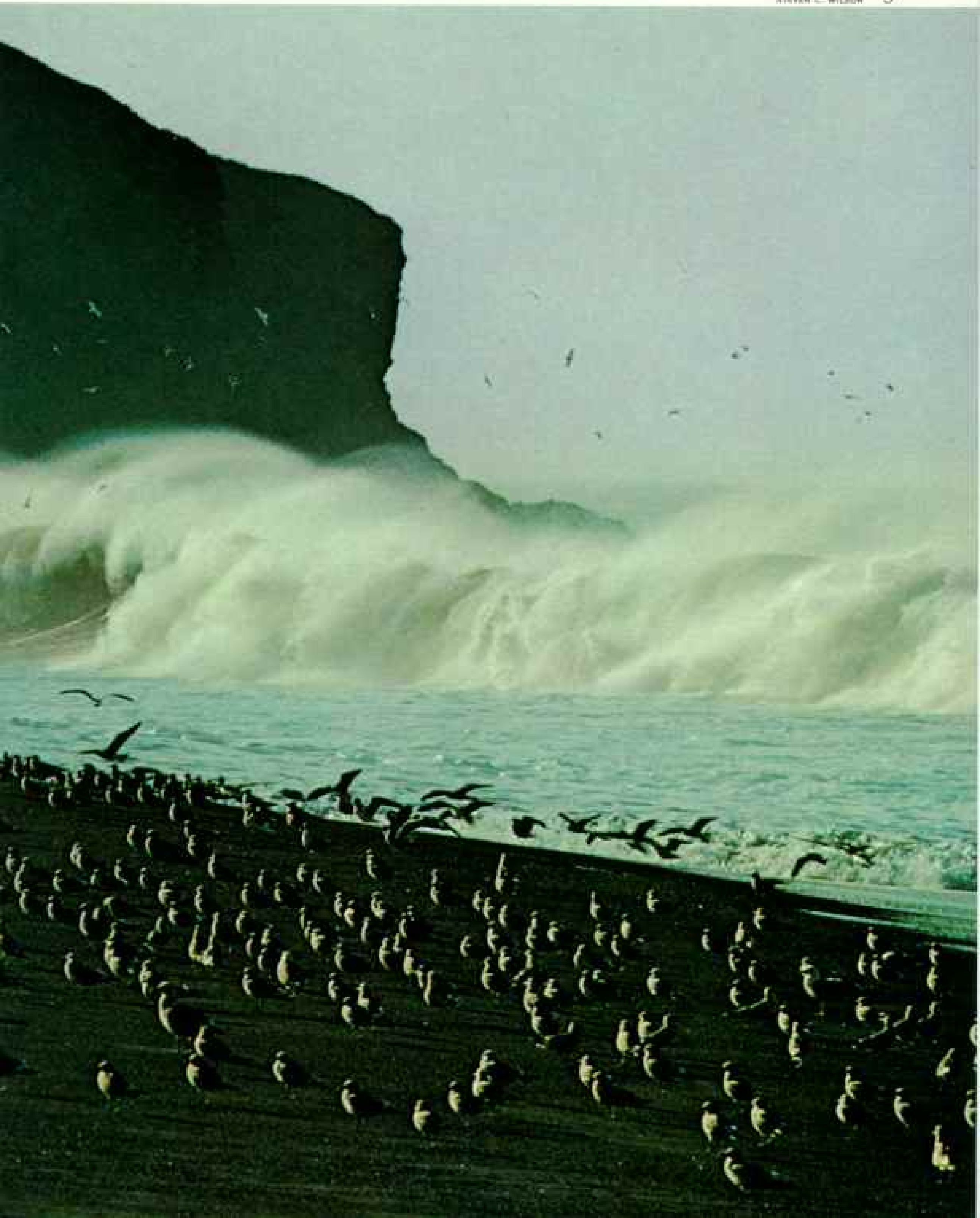
A PORTFOLIO

The ocean sweeps in thunderous rhythm onto the Pacific shore, stirring gulls to flight.



“This land is your land...”

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"...best thing of best of it"

Rustle of browsing deer and songs of birds enrich the dappled peace of a Virginia wood.



“this land is my land...”

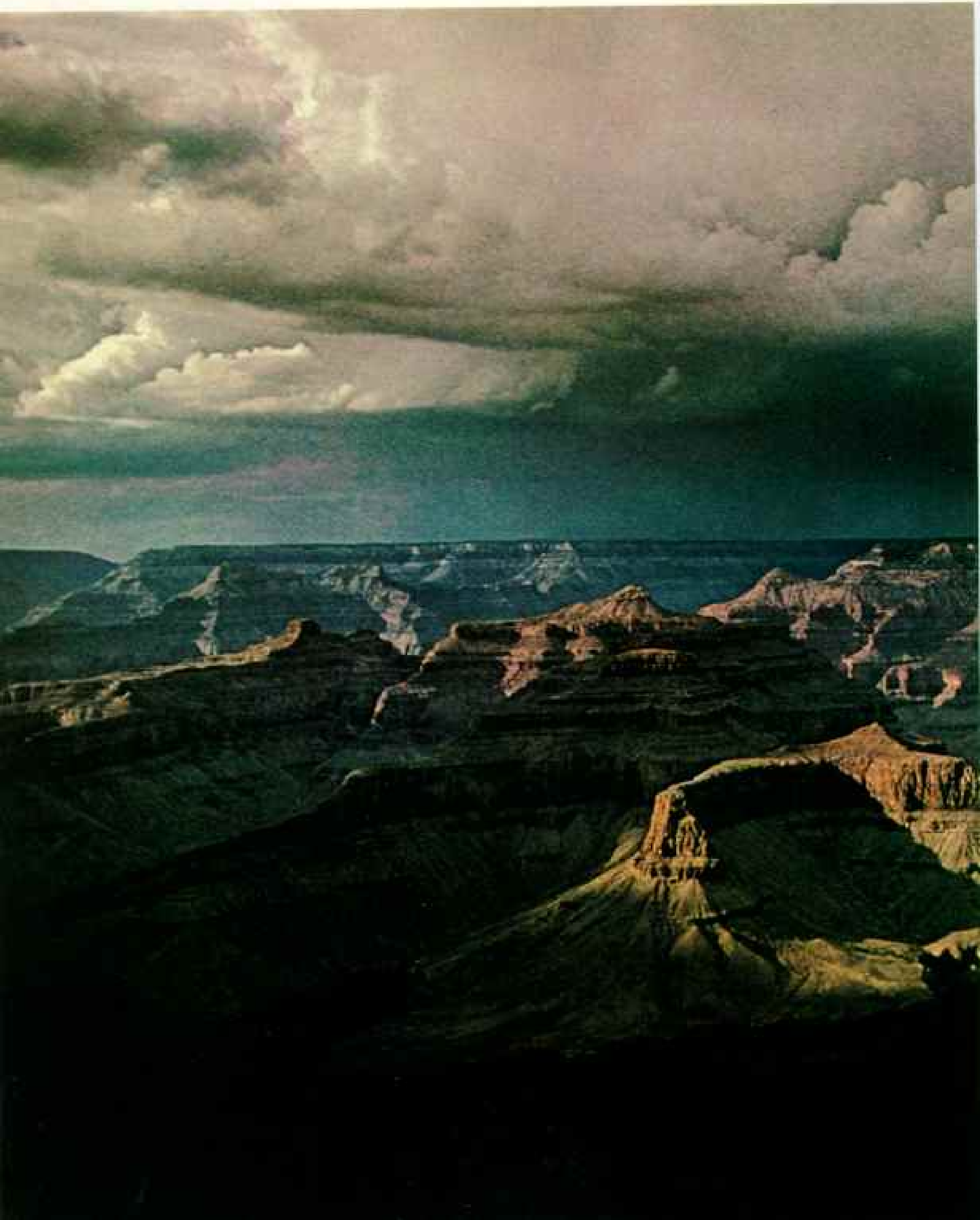
W. E. BARRITT, NATIONAL GEOGRAPHIC STUDY

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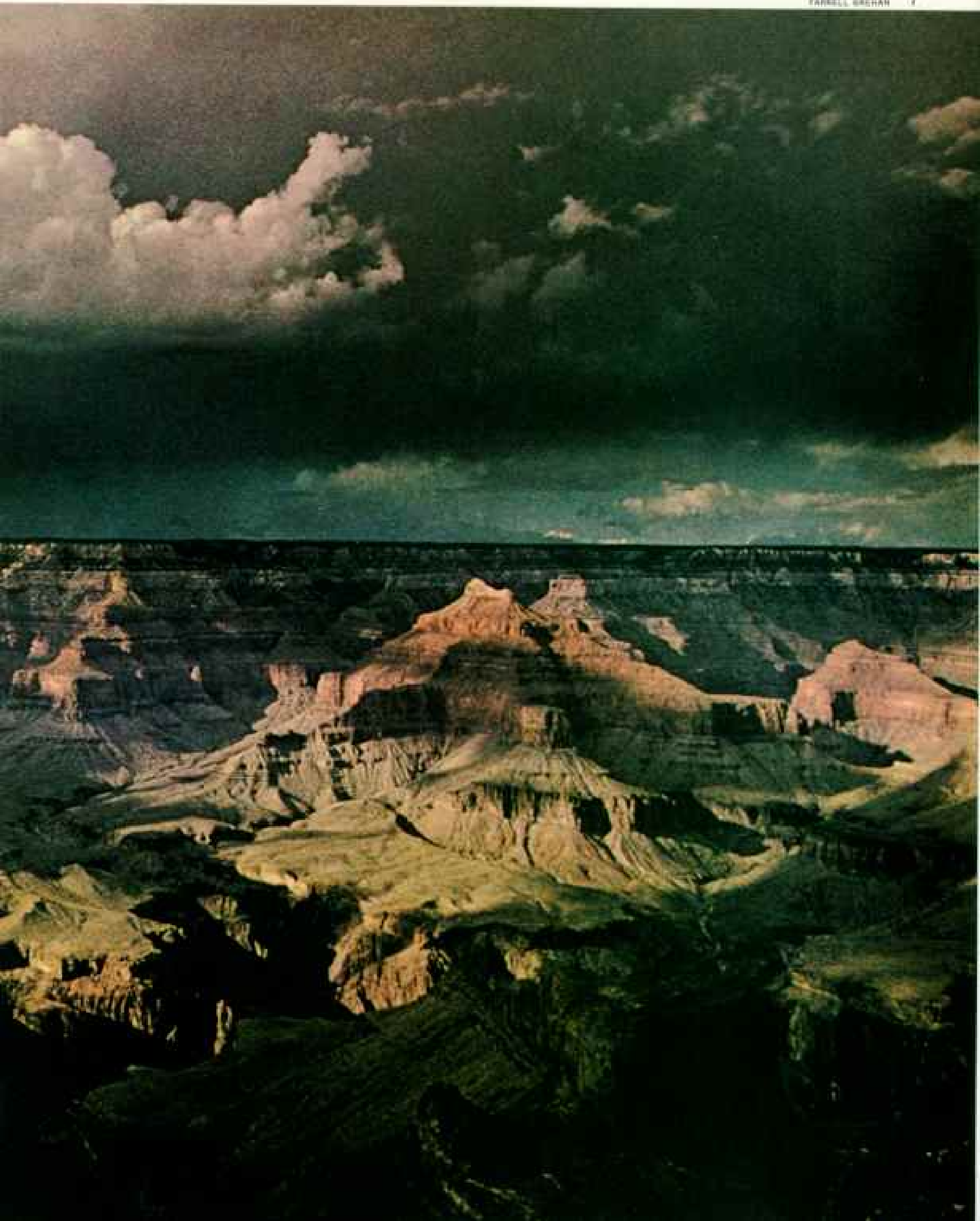
“from California

Like mighty fortresses, ramparts stretch across the Grand Canyon's mottled breadth.



to the New York island..."

FARRELL BREHAN 7



“from the redwood forest

Ghostly travelers on a snow-swept day, bison trek across a Wyoming valley.



to the Gulf Stream waters..."

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“this land was made for you

Autumn regalia of aspens, oaks, and evergreens cloak highlands of the Colorado Rockies.



and me.”

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A First American Views His Land

By N. Scott Momaday

*First Man
behold:
the earth
glitters
with leaves;
the sky
glistens
with rain.
Pollen
is borne
on winds
that low
and lean
upon
mountains.
Cedars
blacken
the slopes—
and pines.*

One hundred centuries ago. There is a wide, irregular landscape in what is now northern New Mexico. The sun is a dull white disk, low in the south; it is a perfect mystery, a deity whose coming and going are inexorable. The gray sky is curdled, and it bears very close upon the earth. A cold wind runs along the ground, dips and spins, flaking drift from a pond in the bottom of a ravine. Beyond

the wind the silence is acute. A man crouches in the ravine, in the darkness there, scarcely visible. He moves not a muscle; only the wind lifts a lock of his hair and lays it back along his neck. He wears skins and carries a spear. These things in particular mark his human intelligence and distinguish him as the lord of the universe. And for him the universe is especially *this* landscape; for him the landscape is an element like the air. The vast, virgin wilderness is by and large his whole context. For him there is no possibility of existence elsewhere.

Directly there is a blowing, a rumble of breath deeper than the wind, above him, where some of the hard clay of the bank is broken off and the clods roll down into the water. At the same time there appears on the skyline the massive head of a long-horned bison, then the hump, then the whole beast, huge and black on the sky, standing to a height of seven feet at the hump, with horns that extend six feet across the shaggy

crown. For a moment it is poised there; then it lumbers obliquely down the bank to the pond. Still the man does not move, though the beast is now only a few steps upwind. There is no sign of what is about to happen; the beast meanders; the man is frozen in repose.

Then the scene explodes. In one and the same instant the man springs to his feet and bolts forward, his arm cocked and the spear held high, and the huge animal lunges in panic, bellowing, its whole weight thrown violently into the bank, its hooves churning and chipping earth into the air, its eyes gone wide and wild and white. There is a moment in which its awful, frenzied motion is wasted, and it is mired and helpless in its fear, and the man hurls the spear with his whole strength, and the point is driven into the deep, vital flesh, and the bison in its agony staggers and crashes down and dies.

This ancient drama of the hunt is enacted again and again in the landscape. The

Snow-banked stream winds through a misty geyser basin in Yellowstone National Park.

STEVEN C. WILSON

man is preeminently a predator, the most dangerous of all. He hunts in order to survive; his very existence is simply, squarely established upon that basis. But he hunts also because he can, because he has the means; he has the ultimate weapon of his age, and his prey is plentiful. His relationship to the land has not yet become a moral equation.

But in time he will come to understand that there is an intimate, vital link between the earth and himself, a link that implies an intricate network of rights and responsibilities. In some unimagined future he will understand that he has the ability to devastate and perhaps destroy his environment. That moment will be one of extreme crisis in his evolution.

The weapon is deadly and efficient. The hunter has taken great care in its manufacture, especially in the shaping of the flint point, which is an extraordinary thing. A larger flake has been removed from each face, a groove that extends from the base nearly to the tip. Several hundred pounds of pressure, expertly applied, were required to make these grooves. The hunter then is an artisan, and he must know how to use rudimentary tools. His skill,

manifest in the manufacture of this artifact, is unsurpassed for its time and purpose. By means of this weapon is the Paleo-Indian hunter eminently able to exploit his environment.

Thousands of years later, about the time that Columbus begins his first voyage to the New World, another man, in the region of the Great Lakes, stands in the forest shade on the edge of a sunlit brake. In a while a deer enters into the pool of light. Silently the man fits an arrow to a bow, draws aim, and shoots. The arrow zips across the distance and strikes home. The deer leaps and falls dead.

But this latter-day man, unlike his ancient predecessor, is only incidentally a hunter; he is also a fisherman, a husbandman, even a physician. He fells trees and builds canoes; he grows corn, squash, and beans, and he gathers fruits and nuts; he uses hundreds of species of wild plants for food, medicine, teas, and dyes. Instead of one animal, or two or three, he hunts many, none to extinction as the Paleo-Indian may have done. He has fitted himself far more precisely into the patterns of the wilderness than did his ancient predecessor. He lives on the land; he takes his living from it; but he does not destroy it. This distinction supports the fundamental ethic that we call conservation today. In principle, if not yet in name, this man is a conservationist.

These two hunting sketches are far less important in themselves than is that long distance between them, that

whole possibility within the dimension of time. I believe that in that interim there grew up in the mind of man an idea of the land as sacred.

*At dawn
eagles
lie and
hover
above
the plain
where light
gathers
in pools.
Grasses
shimmer
and shine.
Shadows
withdraw
and lie
away
like smoke.*

"The earth is our mother. The sky is our father." This concept of nature, which is at the center of the Native American world view, is familiar to us all. But it may well be that we do not understand entirely what that concept is in its ethical and philosophical implications.

I tell my students that the American Indian has a unique investment in the American landscape. It is an investment that represents perhaps thirty thousand years of habitation. That tenure has to be worth something in itself—a great deal, in fact. The Indian has been here a long time; he is at home here. That simple and obvious truth is one of the most important realities of the Indian world, and it is integral in the Indian mind and spirit.

How does such a concept

THE AUTHOR, a Kiowa Indian and winner of the Pulitzer Prize for fiction in 1969, is professor of English at Stanford University. "New World," the poem threaded into the text, is from Mr. Momaday's recent book, *The Gourd Dancer*, Harper & Row, 1976.

IN HOMAGE TO EARTH'S PLENTY, THE PREHISTORIC NUMBERS INDIANS OF NEW MEXICO PAINTED REALISTIC FISH (BELOW) AND BIRDS (LOWER RIGHT) ON THEIR POTTERY.



evolve? Where does it begin? Perhaps it begins with the recognition of beauty, the realization that the physical world *is* beautiful. We don't know much about the ancient hunter's sensibilities. It isn't likely that he had leisure in his life for the elaboration of an aesthetic ideal. And yet the weapon he made was beautiful as well as functional. It has been suggested that much of the minute chipping along the edges of his weapon served no purpose but that of aesthetic satisfaction.

A good deal more is known concerning that man of the central forests. He made beautiful boxes and dishes out of elm and birch bark, for example. His canoes were marvelous, delicate works of art. And this aesthetic perception was a principle of the whole Indian world of his time, as indeed it is of our time. The contemporary Native American is a man whose strong aesthetic perceptions are clearly evident in his arts and crafts, in his religious ceremonies, and in the stories and songs of his

rich oral tradition. This, in view of the pressures that have been brought to bear upon the Indian world and the drastic changes that have been effected in its landscape, is a blessing and an irony.

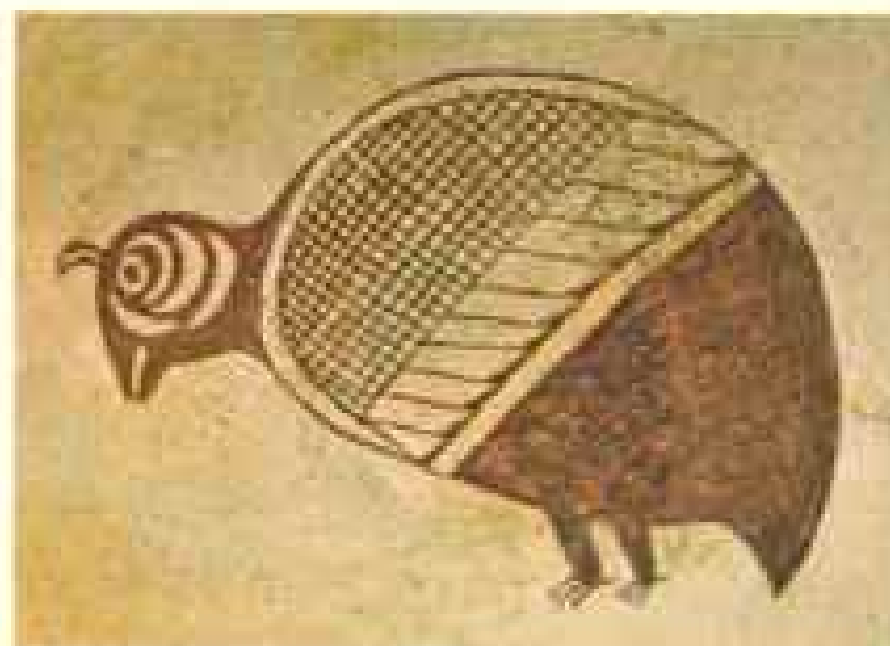
Consider for example the Navajos of the Four Corners area. In recent years an extensive coal-mining operation has mutilated some of their most sacred land. A large power plant in that same region spews a contamination into the sky that is visible for many miles. And yet, as much as any people of whom I have heard, the Navajos perceive and celebrate the beauty of the physical world.

There is a Navajo ceremonial song that celebrates the sounds that are made in the natural world, the particular voices that beautify the earth:

*Voice above,
Voice of thunder,
Speak from the
dark of clouds;
Voice below,
Grasshopper voice,
Speak from the
green of plants;
So may the earth
be beautiful.*

There is in the motion and meaning of this song a comprehension of the world that is peculiarly native, I believe, that is integral in the Native American mentality. Consider: The singer stands at the center of the natural world, at the source of its sound, of its motion, of its life.

Nothing of that world is inaccessible to him or lost upon him. His song is filled with reverence, with wonder and delight, and with confidence as well. He knows something about himself and about the things around him—and he knows that he knows. I am interested in what he sees and hears; I am interested in the range and force of his perception. Our immediate impression may be that his perception is narrow and deep—vertical. After all, “voice above . . . voice below,” he sings. But is it vertical only? At each level of his expression there is an extension of his awareness across the whole landscape. The voice above is the voice of thunder, and thunder rolls. Moreover, it issues from the impalpable dark clouds and runs upon their horizontal range. It is a sound that integrates the whole of the atmosphere. And even so, the voice below, that of the grasshopper, issues from the broad plain and multiplicity of plants. And of course the singer is mindful of much more than thunder and insects; we are given in his song the wide angle of his vision and his hearing—and



NATIONAL GEOGRAPHIC PHOTOGRAPHER VOLMAR WENTZEL, FROM THE RICHARD ELLISON COLLECTION (TOP) AND THE ROY EVANS COLLECTION

we are given the testimony of his dignity, his trust, and his deep belief.

This comprehension of the earth and air is surely a matter of morality, for it brings into account not only man's instinctive reaction to his environment but the full realization of his humanity as well, the achievement of his intellectual and spiritual development as an individual and as a race.

In my own experience I have seen numerous examples of this regard for nature. My grandfather Mammedaty was a farmer in his mature years; his grandfather was a buffalo hunter. It was not easy for Mammedaty to be a farmer; he was a Kiowa, and the Kiowas never had an agrarian tradition. Yet he had to make his living, and the old, beloved life of roaming the plains and hunting the buffalo was gone forever. Even so, as much as any man before him, he fitted his mind and will and spirit to the land; there was nothing else. He could not have conceived of living apart from the land.

In *The Way to Rainy*



YOLKMAR WENTZEL, FROM THE EISELE COLLECTION, WESTERN NEW MEXICO UNIVERSITY MUSEUM (ARROW), AND THE RICHARD ELLISON COLLECTION (FADING PAGE)

Mountain I set down a small narrative that belongs in the oral tradition of my family. It indicates something essential about the Native American attitude toward the land:

"East of my grandmother's house, south of the pecan grove, there is buried a woman in a beautiful dress. Mammedaty used to know where she is buried, but now no one knows. If you stand on the front porch of the house and look eastward towards Carnegie, you know that the woman is buried somewhere within the range of your vision. But her grave is unmarked. She was buried in a cabinet, and she wore a beautiful dress. How beautiful it was! It was one of those fine buckskin dresses, and it was decorated with elk's teeth and beadwork. That dress is still there, under the ground."*

It seems to me that this statement is primarily a declaration of love for the land, in which the several elements—the woman, the dress, and this plain—are at last become one reality, one expression of the beautiful in nature. Moreover, it seems to me a peculiarly Native American expression in this sense: that the concentration of things that are explicitly remembered—the general landscape, the simple, almost abstract nature of the burial, above all the beautiful dress, which is wholly singular in kind (as well as in its function within the narrative)—is especially Indian in character. The things that are *not* explicitly remembered—the

woman's name, the exact location of her grave—are the things that matter least in the special view of the storyteller. What matters here is the translation of the woman into the landscape, a translation particularly signified by means of the beautiful and distinctive dress, an *Indian* dress.

When I was a boy, I lived for several years at Jemez Pueblo, New Mexico. The Pueblo Indians are perhaps more obviously invested in the land than are other people. Their whole life is predicated upon a thorough perception of the physical world and its myriad aspects. When I first went there to live, the cacique, or chief, of the Pueblos was a venerable old man with long, gray hair and bright, deep-set eyes. He was entirely dignified and imposing—and rather formidable in the eyes of a boy. He excited my imagination a good deal. I was told that this old man kept the calendar of the tribe, that each morning he stood on a certain spot of ground near the center of the town and watched to see where the sun appeared on the skyline. By means of this solar calendar did he know and announce to his people when it was time to plant, to harvest, to perform this or that ceremony. This image of him in my mind's eye—the old man gazing each morning after the ranging sun—came

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RAID ON A BIRD'S NEST (LEFT) AND HARVEST OF HONEY (FACING PAGE) DECORATE NIMBRES BURIAL POTS PLACED OVER THE HEADS OF THE DEAD. BOWLS WERE "KILLED" BY PUNCHING HOLES IN THE BOTTOMS, THIS FREEDING THEIR SPIRITS.



to represent for me the epitome of that real harmony between man and the land that signifies the Indian world.

One day when I was riding my horse along the Jemez River, I looked up to see a long caravan of wagons and people on horseback and on foot. Men, women, and children were crossing the river ahead of me, moving out to the west, where most of the cultivated fields were, the farmland of the town. It was a wonderful sight to see, this long procession, and I was immediately deeply curious. I wanted to investigate, but it was not in me to do so at once, for that racial reserve, that sense of propriety that is deep-seated in Native American culture, stayed me, held me up. Then I saw someone coming toward me on horseback, galloping. It was a friend of mine, a boy of my own age. "Come on," he said. "Come with us." "Where are you going?" I asked casually. But he would not tell me. He simply laughed

and urged me to come along, and of course I was very glad to do so. It was a bright spring morning, and I had a good horse under me, and the prospect of adventure was delicious. We moved far out across the eroded plain to the farthest fields at the foot of a great red mesa, and there we planted two large fields of corn. And afterward, on the edge of the fields, we sat on blankets and ate a feast in the shade of a cottonwood grove. Later I learned it was the cacique's fields we planted.

And this is an ancient tradition at Jemez. The people of the town plant and tend and harvest the cacique's fields, and in the winter the hunters give to him a portion of the meat that they bring home from the mountains. It is as if the cacique is himself the translation of man, every man, into the landscape.

I have not forgotten that day, nor shall I forget it. I remember the warm earth of the fields, the smooth texture of seeds in my hands, and the brown water moving slowly and irresistibly among the rows. Above all I remember the spirit in which the procession was made, the work was done, and the feasting was enjoyed. It was a spirit of communion, of the life of each man in relation to the life of the planet and of the infinite distance and silence in which it moves. We made, in concert, an appropriate expression of that spirit.

One afternoon an old Kiowa woman talked to me, telling me of the place in

Oklahoma in which she had lived for a hundred years. It was the place in which my grandparents, too, lived; and it is the place where I was born. And she told me of a time even further back, when the Kiowas came down from the north and centered their culture in the red earth of the southern plains. She told wonderful stories, and as I listened, I began to feel more and more sure that her voice proceeded from the land itself. I asked her many things concerning the Kiowas, for I wanted to understand all that I could of my heritage. I told the old woman that I had come there to learn from her and from people like her, those in whom the old ways were preserved. And she said simply: "It is good that you have come here." I believe that her word "good" meant many things; for one thing it meant *right*, or *appropriate*. And indeed it was appropriate that she should speak of the land. She was eminently qualified to do so. She had a great reverence for the land, and an ancient perception of it, a perception that is acquired only in the course of many generations.

It is this notion of the appropriate, along with that of the beautiful, that forms the Native American perspective on the land. In a sense these considerations are indivisible; Native American oral tradition is rich with songs and tales that celebrate natural beauty, the beauty of the natural world. What is more appropriate to our world

than that which is beautiful?

*At noon
turtles
enter
slowly
into
the warm
dark loam.
Bees hold
the swarm.
Meadows
recede
through planes
of heat
and pure
distance.*

Very old in the Native American world view is the conviction that the earth is vital, that there is a spiritual dimension to it, a dimension in which man rightly exists. It follows logically that there are ethical imperatives in this matter. I think: Inasmuch as I am in the land, it is appropriate that I should affirm myself in the spirit of the land. I shall celebrate my life in the world and the world in my life. In the natural order man invests himself in the landscape and at the same time incorporates the landscape into his own most fundamental experience. This trust is sacred.

The process of investment and appropriation is, I believe, preeminently a function of the imagination. It is accomplished by means of an act of the imagination that is especially ethical in kind. We are what we imagine

ourselves to be. The Native American is someone who thinks of himself, imagines himself in a particular way. By virtue of his experience his idea of himself comprehends his relationship to the land.

And the quality of this imagining is determined as well by racial and cultural experience. The Native American's attitudes toward this landscape have been formulated over a long period of time, a span that reaches back to the end of the Ice Age. The land, *this* land, is secure in his racial memory.

In our society as a whole we conceive of the land in terms of ownership and use. It is a lifeless medium of exchange; it has for most of us, I suspect, no more spirituality than has an automobile, say, or a refrigerator. And our laws confirm us in this view, for we can buy and sell the land, we can exclude each other from it, and in the context of ownership we can use it as we will. Ownership implies use, and use implies consumption.

But this way of thinking of the land is alien to the Indian. His cultural intelligence is opposed to these concepts; indeed, for him they are all but inconceivable quantities. This fundamental distinction is easier to understand with respect to ownership than to use, perhaps. For obviously the Indian does use, and has

always used, the land and the available resources in it. The point is that *use* does not indicate in any real way his idea of the land. "Use" is neither his word nor his idea. As an Indian I think: "You say that I *use* the land, and I reply, yes, it is true; but it is not the first truth. The first truth is that I *love* the land; I see that it is beautiful; I delight in it; I am alive in it."

In the long course of his journey from Asia and in the realization of himself in the New World, the Indian has assumed a deep ethical regard for the earth and sky, a reverence for the natural world that is antipodal to that strange tenet of modern civilization that seemingly has it that man must destroy his environment. It is this ancient ethic of the Native American that must shape our efforts to preserve the earth and the life upon and within it.

*At dusk
the gray
foxes
stiffen
in cold;
blackbirds
are fixed
in white
branches.
Rivers
follow
the moon,
the long
white track
of the
full moon.* □

Leaving their signature on the land, Indians scraped giant human and animal figures on the desert near Blythe, California, perhaps as messages to the gods. The human effigy measures 170 feet. Tire tracks add a modern inscription. Rich in symbols of harvest and hunt, Indian art vividly celebrates nature's beneficence. HOWARD GARDNER



This Land of Ours— How Are We Using It?

By Peter T. White

Photographs by Emory Kristof

BOTH NATIONAL GEOGRAPHIC STAFF

Which has priority, a healthy economy or a healthy environment? Job-conscious citizens in Utah (below) stage a demonstration favoring construction of a power plant. An ecology-concerned citizen in New Hampshire (right) campaigns against a proposed paper mill. Both dramatize a key question of our day.

IN THE MIDDLE of our most crowded urban area—in downtown Jersey City, New Jersey, within sight of the towers of Manhattan—a retired machinist who was born in Italy lives in a row of four-story houses. In his backyard he grows eggplants and peppers, figs, beautiful beefsteak tomatoes. He says it's his greatest satisfaction.

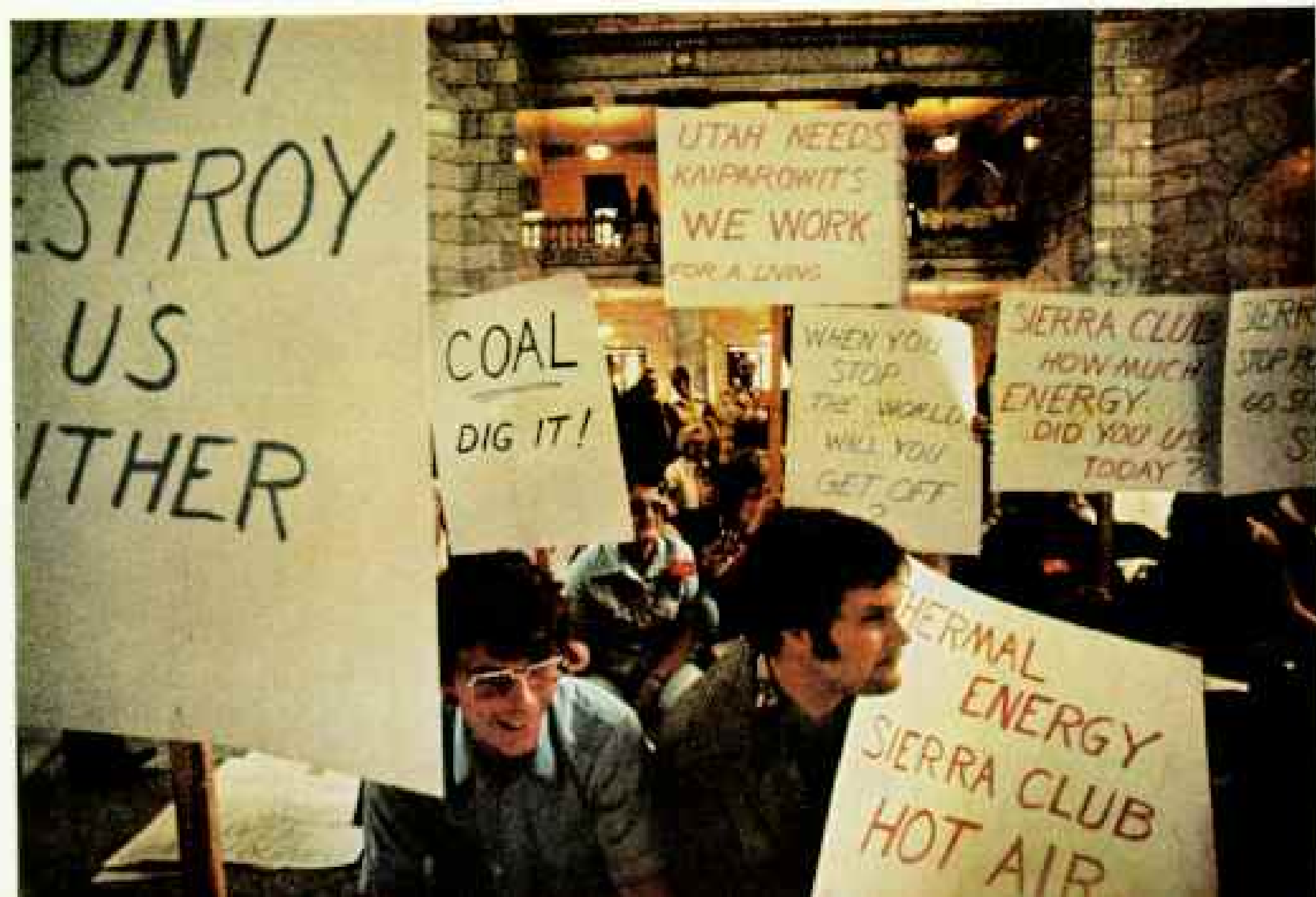
Now meet a well-to-do film actor in Los Angeles. He's been investing, or as he says himself, speculating, in real estate: "I've had setbacks, but on the whole I've done splendidly." Now he's big on natural gas.

Each of these men uses land to get out of it something he wants very much. Something material. Something spiritual.

So does the hiker, the climber, the boater, the skier, the bird-watcher, the hunter.

As for making money out of the land, can one count the ways? It's done by the farmer, the rancher, the miner, the lumberman, the real-estate developer, the builder. By that fictitious legal person, the conglomerate corporation—pumping oil, buying coal leases, selling building lots, farming thousands of acres. By the banker lending to them all, by the lawyers fighting their many battles.

In short, uses of land are so varied—and give rise to such powerful and conflicting feelings, laws, plans, and regulations—that in recent years land use has become a subject of public interest widely and consistently prone to controversy. Some of these controversies are growing into what many people



think will be a crucial issue in the third century of our independence: To what extent can public authority tell a man what he can do or cannot do with his property?

Consider this recent and typical news item: Walpole, New Hampshire—Voters will express their sentiments today on whether a 200-million-dollar pulp mill should be built on farmland along the Connecticut River. Critics claim it would bring sulfurous stench, strip forests, and ruin roads with heavy trucks. Proponents claim it would create jobs, keep young people from leaving, and boost the local economy and tax base. . . .

Land use and taxes mean life or death for towns

Ah, taxes! Here's a fruit of land use very much wanted by mayors and elected heads of all our assorted local governments: some 3,000 counties, 18,000 municipalities, and 34,000 townships and school districts. Their

taxes on real property, meaning land and so-called improvements on it, total 40 billion dollars a year. That's nearly a third of all the money those governments have to spend.

Results from Walpole: 690 for the pulp mill, 866 against! The largest turnout of voters ever. The pulp people may try in the next county, or over in Vermont.

My first whiff of land-use fervor had come one evening in Fairfax County, Virginia. The

Board of Supervisors was considering Rezoning Application C-643: Shall 73 acres of undeveloped land be turned into an industrial park or developed for housing? And if so, how many units per acre? This sort of confrontation comes up in suburbia every day. Some citizens complain that they are taxed for sewers and roads so some developer can realize maximum profit; developers counter that they provide people with places to live.

The landowner's attorney notes that a land-use plan of 1970 specified industrial use for the site—a major tax producer! But he'll be reasonable, and accept five homes to an acre. From the floor the arguments fly:

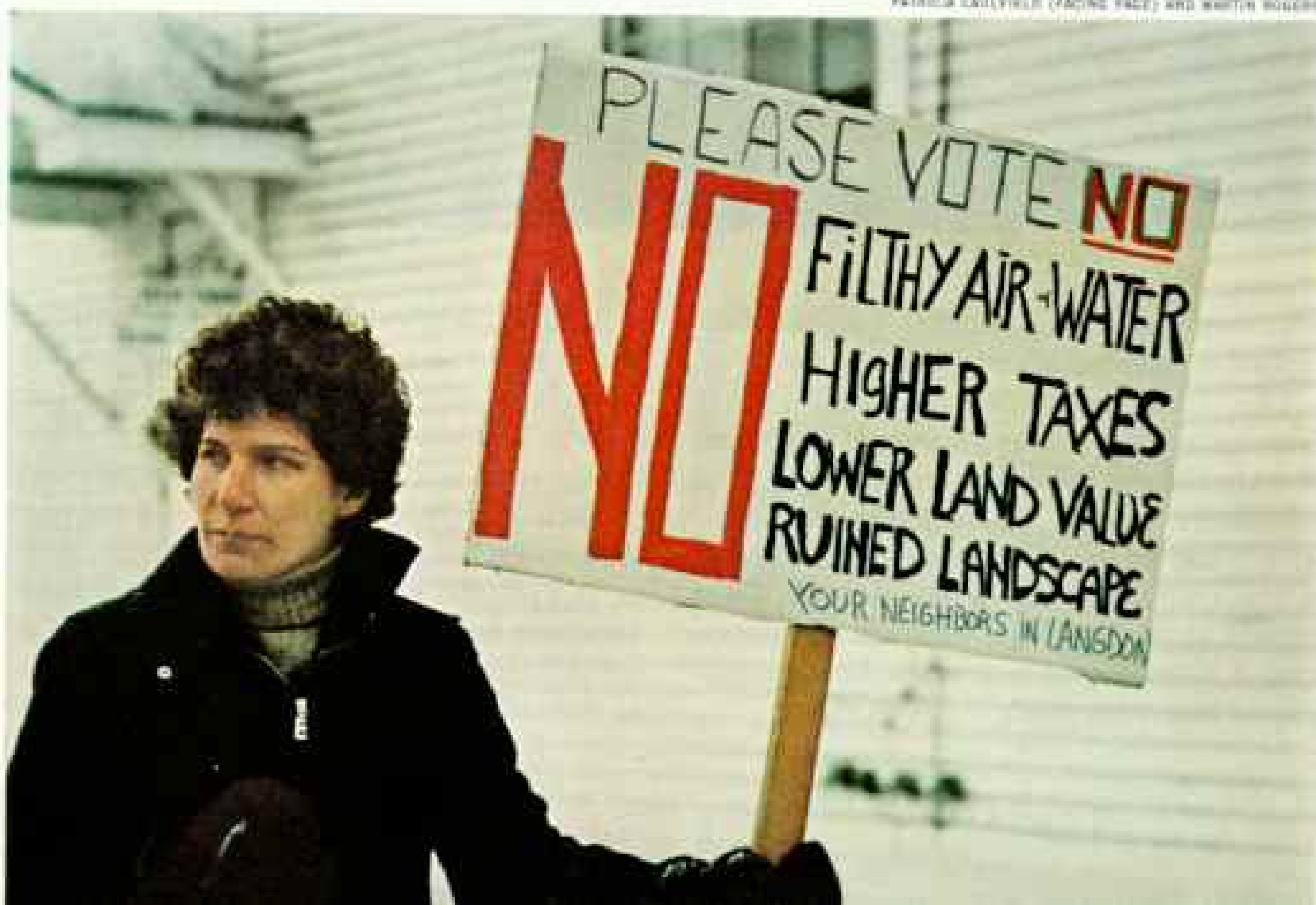
"Dumping so many people there will bring traffic congestion, it'll ruin our nice neighborhood nearby. We must defend the quality of life!"

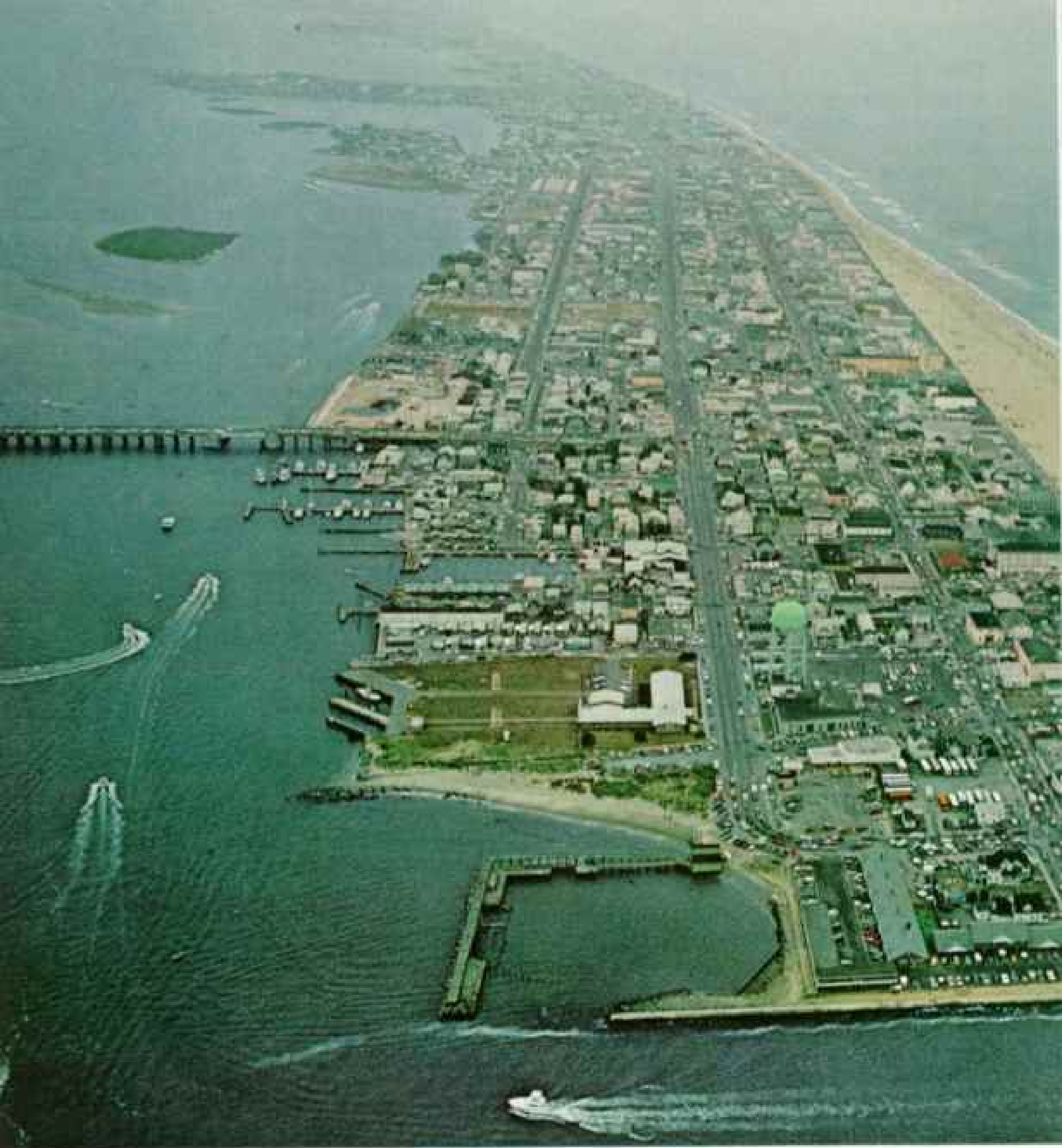
"This could cost everybody hundreds of dollars each, for new access roads. The time of freewheeling development must end!"

"But the man is entitled to a reasonable return. You can't dictate in a democracy!"

A man gets up and says he's done some research: The original 114-acre tract was bought thirty years ago for \$9,350. A power company paid \$10,000 for a nine-acre easement in 1948. Five acres were sold a decade later for \$45,500, then another 22 acres for \$97,500. On an investment of less than \$10,000, there had already been a return of \$150,000. "What's left now, if sold in one-acre lots, would bring \$1,400,000! But no, the

PATRICIA CALLFIELD (FACING PAGE) AND WHITIN BOGERS





developer expects \$3,000,000. I'm not anti-capitalist, but enough is enough."

This is a county where young George Washington worked as a surveyor (see pages 90-111). He was enthusiastic about land as an investment too. He did well with rich farmland in the Ohio Valley, and with his shares in the Dismal Swamp Company. On some acreage along New York's Mohawk River, he tripled his money in nine years. Tonight's applicant hopes for thirty times as much.

Around midnight the supervisors turn him down, seven to one. They cite a new county-wide land-use plan for carefully managed growth. The attorney says it's unfair, confiscatory, and unconstitutional; he's going to court.

Then and there I hit upon a land-use plan of my own: To travel from Atlantic to Pacific to glimpse the many kinds of land we have, high and low and wet and dry. To see what we've been doing with it all—in the country, in the cities—and to write what people feel

WILD SHORE NO LONGER,
*much of America's eastern
coastline—as here at Ocean
City, Maryland—suffers
from a near-terminal case
of runaway development.*



should or shouldn't be done with it, and why.

My wife said, "You do that, and everybody'll be mad at you."

I told her they shouldn't be—I'll only be reporting what they say in their own interest. To press for one's interest is perfectly all right in our Republic. James Madison said so in *The Federalist*, Paper No. 10. . . .

"A lot of good that'll do you," she said. "Good luck!"

By early summer, I am rolling through

New England in a mobile home with kitchen, shower, toilet, telephone, and drawers full of soil maps, research studies, and statistics.

I see the hills of Maine—spruce and fir trees everywhere, some sugar maples; a river a quarter of a mile wide with a mile-long log-jam, a river of timber. Then occasional clearings with corn; churches with white spires, a pulp mill, an Air Force radar site.

In old mill towns of New Hampshire, Massachusetts, and Connecticut, I see a repeated

pattern. In the center, along the river, loom multistory brick textile plants, empty now, a sign of the past; on the outskirts, wooden town houses cluster in leafy settings and shopping centers sprawl near superhighways, signs of the present. I stop to visit a huge new J C Penney store—a remarkable land-use manifestation. It's a tax shelter.

Such buildings are put up by investors who rent them to store chains. Each year the investors add up interest on borrowed capital, accelerated depreciation, and real-estate taxes; the excess of all this over rental income is "net loss"—deductible from ordinary income, which might otherwise be subject to extremely high individual income-tax rates.

Thus sheltered, a man with a salary of \$100,000 a year may pay a few hundred dollars instead of \$42,000. Eventually he'll own the building as well. It's legal, and a major factor in the shopping-center explosion on farmland across the country. This, in turn, pushes up land values, which to working farmers may mean abruptly higher taxes—often the difference between continuing to farm or being squeezed out.

I see dairy cows grazing in upstate New York. "Not as many as there used to be," says an old farmer; a lot of former dairy farms now are tax shelters too, producing valuable operating losses for high-income city people, while land values rise. They hope for profitable subdividing later.

Along Interstate 90 paralleling Lake Erie in Pennsylvania and Ohio, it's apple orchards and Concord grapes; ornamental shrubs for sale all over the East; tomatoes for canning.

Finally Cleveland, an old steel and railroad city with characteristic ups and downs. The affluent still inhabit Shaker Heights, one of America's first big suburban developments: broad boulevards, artificial lakes, very smart fifty years ago, and still desirable. En route downtown, I pass desolate stretches of houses. A city official calls them "O.V. and V." That means open, vacant, and vandalized.

The estate whence John D. Rockefeller surveyed his early oil empire is now a park, next to a decaying neighborhood. In the city center,

in a breezy new lakeside mall with colorful hot-dog stands, a lunchtime crowd from office buildings listens to jazz. A real-estate man tells me the exodus of city dwellers to the suburbs has bottomed out, that in the next twenty years quite a few people will think about moving back into the city: "Well-paid younger people, older people without kids. To cash in on that market, we're working to make the city more attractive."

All our cities and towns and suburbs take up only half as much land as is devoted to corn or to wheat. They occupy no more than 40 million acres—barely 2 percent of the land of the contiguous 48 states. But that's where 75 percent of our 215 million people live.

Going west on the toll road, I see migrant workers harvesting cucumbers, and machines cutting hundreds of acres of mint, for chewing gum and toothpaste; mint's up in price, says the farmer—he'll buy more land farther north, in Michigan.

I drive past oil refineries and the steel mills of Gary, Indiana, into downtown Chicago, past the world's oldest skyscrapers, and some of the newest. And the tallest—the 110-story Sears Tower. It symbolizes the optimism of the 1960's, and soaring real-estate values.

In 1945, mortgages totaled 35 billion dollars, a seventh the size of the U.S. public debt. Today, with our debt at 577 billion, mortgages—which all produce income—are up to 749 billion! That's more than the value of all the bonds issued by corporations, states, and local governments put together, and only slightly less than the market value of all stocks at the end of 1975.

More than half of that total is invested in homes, primarily by savings and loan associations. But the biggest institutional backers for apartment houses and commercial buildings are the life-insurance companies.

Another impetus for colossal buildings in the heart of cities has been the striving for an impressive corporate image—the General Motors Building in New York City, the Transamerica Building in San Francisco. In Chicago, I visit the John Hancock Center: six floors with shops, seven floors for parking, 28 office floors. Then a restaurant, a swimming pool, a supermarket—and condominiums, 48 floors of them. Says the architect, "Half the people living here don't even need cars."

I head out into the heart of the corn belt.

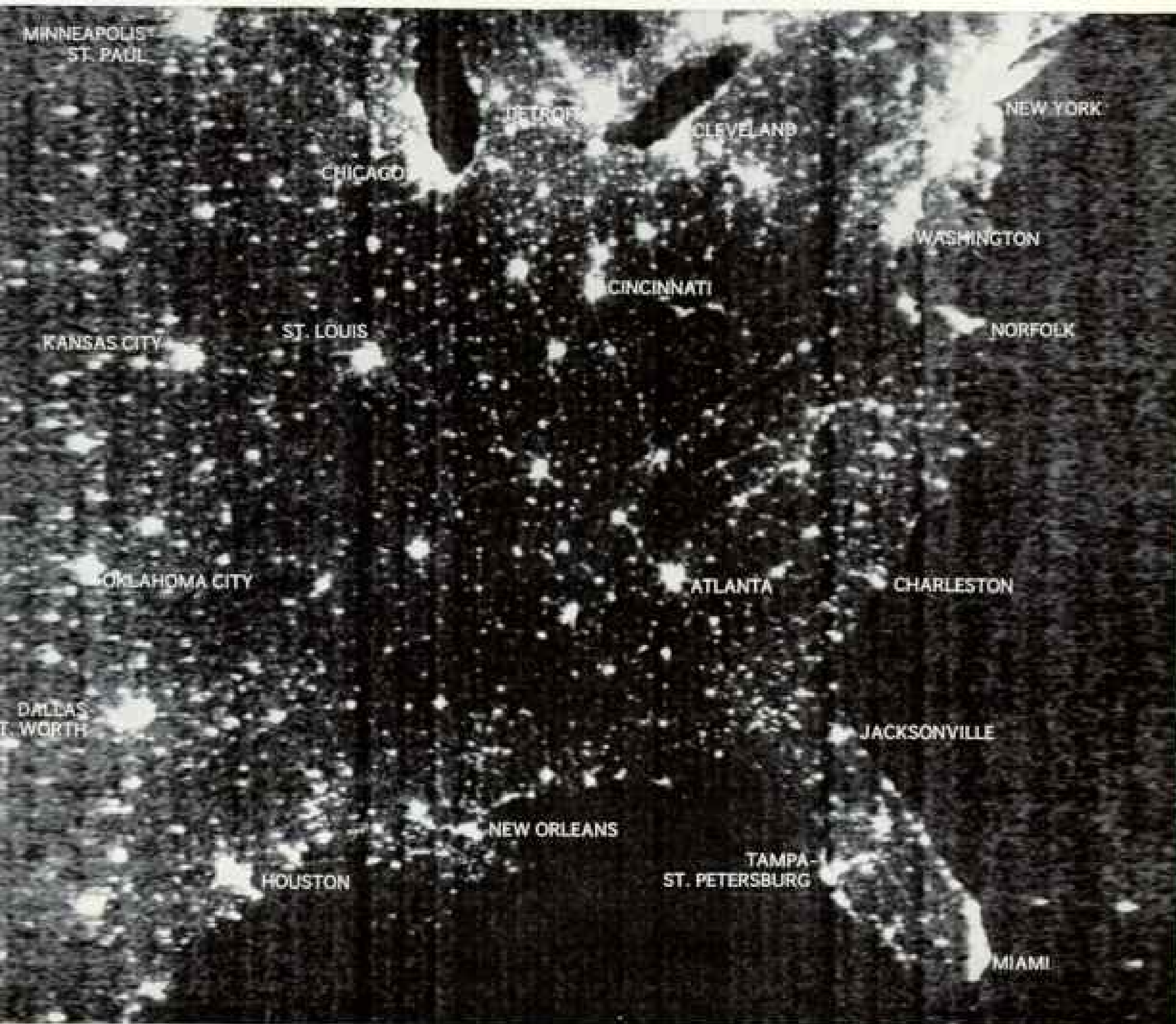
City malls and skyscrapers mark a nation's optimism

Two-thirds of the land is devoted to crops; corn to the right of me, soybeans to the left of me; a grain elevator, and more beans and knee-high corn for miles and miles, in enormous squared-off patches. That's feed corn, mostly, for livestock; also for grits, for salad oil and margarine. A lot goes abroad.

The grain elevators get bids several times daily, farmers follow prices anxiously; if you've got 42,000 bushels of corn, a day's fluctuation of ten cents means you're \$4,200 richer or poorer. "It isn't so much how many bushels you get an acre," an extension agent

tells me, "it's when you sell them. A farmer with grain in his bin is a speculator too."

Past a corn-bordered shopping center, a golf course, a car dealer's lot, a huge mobile-home park, I arrive in Bloomington, in McLean County, largest in Illinois. It's said that 1,700 covered wagons rolled through here in a single month of 1854, headed west beyond Peoria to break more of the tallgrass prairie. Today, if a Bloomington builder wants to put up another tire or vacuum-cleaner plant, it may be permitted in the surrounding buffer zone—but beyond. *(Continued on page 39)*



U.S. AIR FORCE

Man-made Milky Way spangles close to half of the United States in this nighttime weather-satellite view. Megalopolises blaze like supernovas—flaring symbols of a nation that devours 35 percent of the world's total energy output each year. Small towns along heavily developed highway corridors show up as glowing strands webbing the urban conglomerates.



Changing miracle - the American land

IN THIS BICENTENNIAL YEAR, the land remains as big a challenge as ever—but it is a challenge of conscience rather than of conquest.

The uncontrolled development of decades past is coming, perforce, to a halt. When private development conflicts with the public good, the former

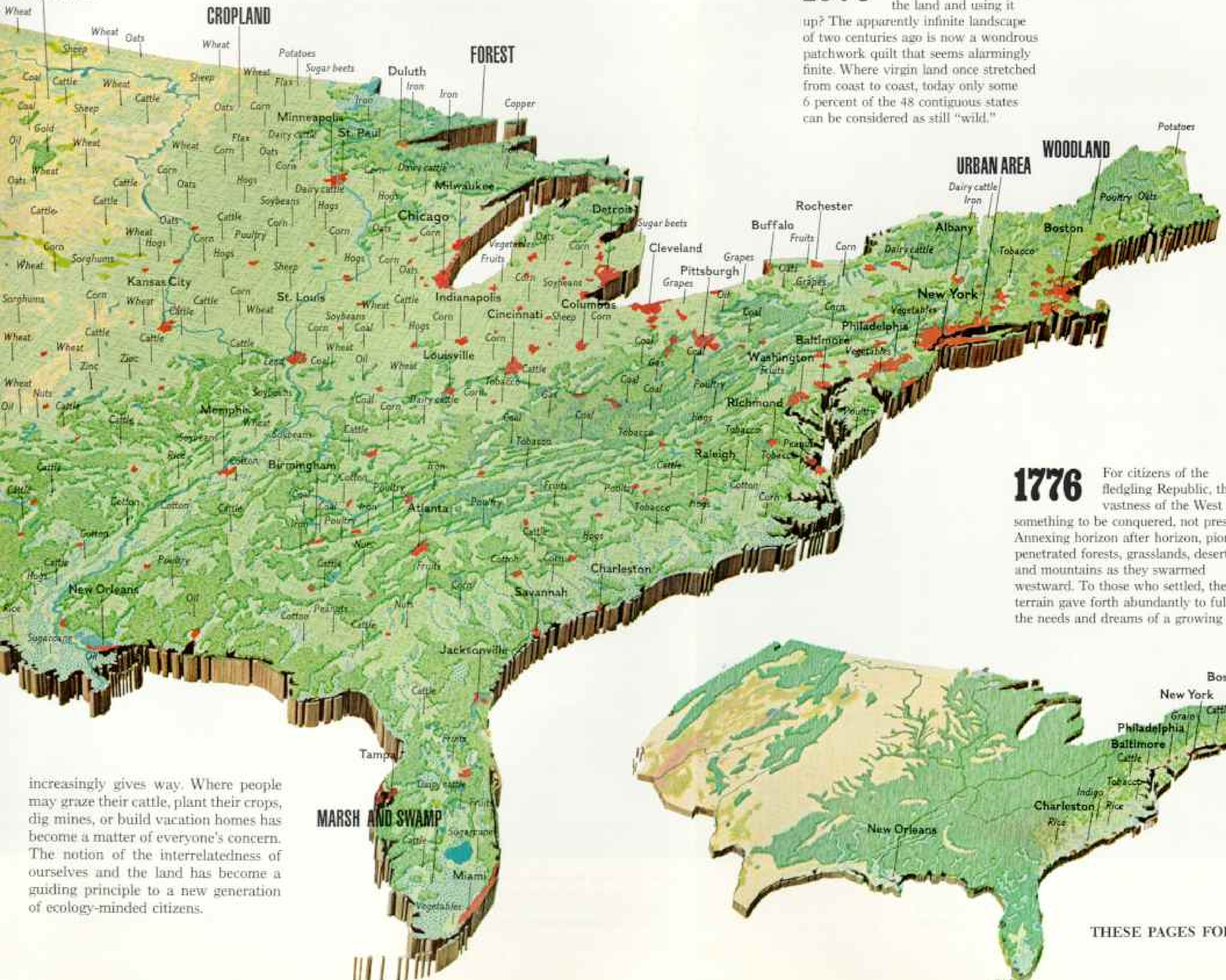
GRASSLAND

CROPLAND

FOREST

WOODLAND

URBAN AREA



1976

Where do you draw the line between using the land and using it up? The apparently infinite landscape of two centuries ago is now a wondrous patchwork quilt that seems alarmingly finite. Where virgin land once stretched from coast to coast, today only some 6 percent of the 48 contiguous states can be considered as still "wild."

1776

For citizens of the fledgling Republic, the vastness of the West was something to be conquered, not preserved. Annexing horizon after horizon, pioneers penetrated forests, grasslands, deserts, and mountains as they swarmed westward. To those who settled, the fertile terrain gave forth abundantly to fulfill the needs and dreams of a growing nation.

increasingly gives way. Where people may graze their cattle, plant their crops, dig mines, or build vacation homes has become a matter of everyone's concern. The notion of the interrelatedness of ourselves and the land has become a guiding principle to a new generation of ecology-minded citizens.

MARSH AND SWAMP

THESE PAGES FOLD OUT

In this land of plenty, is there such a thing

LOS ANGELES INTERCHANGE, EDWIN SHERER



Everything has its price. To become earth's most mobile nation, we have ringed our cities with corsets of concrete, using up great swaths of suburban acreage.

SPRINGFLOWS AT WORK IN NEBRASKA/GEORG SHERER



Land is the force that makes us the richest farm nation. Mechanization eliminates farm jobs, but here in western Nebraska irrigation greens lands never plowed before.

CONDOMINIUMS AT OCEAN CITY, NATHAN



Everyone dreams of a second home for leisure hours. These luxury high rises give residents a glorious view of the Atlantic—but those behind them no view at all. Many stand empty as the boom in condominiums tapers off.

as too much?

MOBILE HOMES AT OCEAN CITY



Choice lots in this mobile-home development — just a mile from the oceanfront condominiums at left — sell for as much as \$25,000 each.

CLEAR-CUT AREA RECOVERING REDWOOD NATIONAL PARK, MARTIN LITTON



Clear-cutting means lower lumber prices, but if new trees are not planted promptly, erosion may devastate the land.

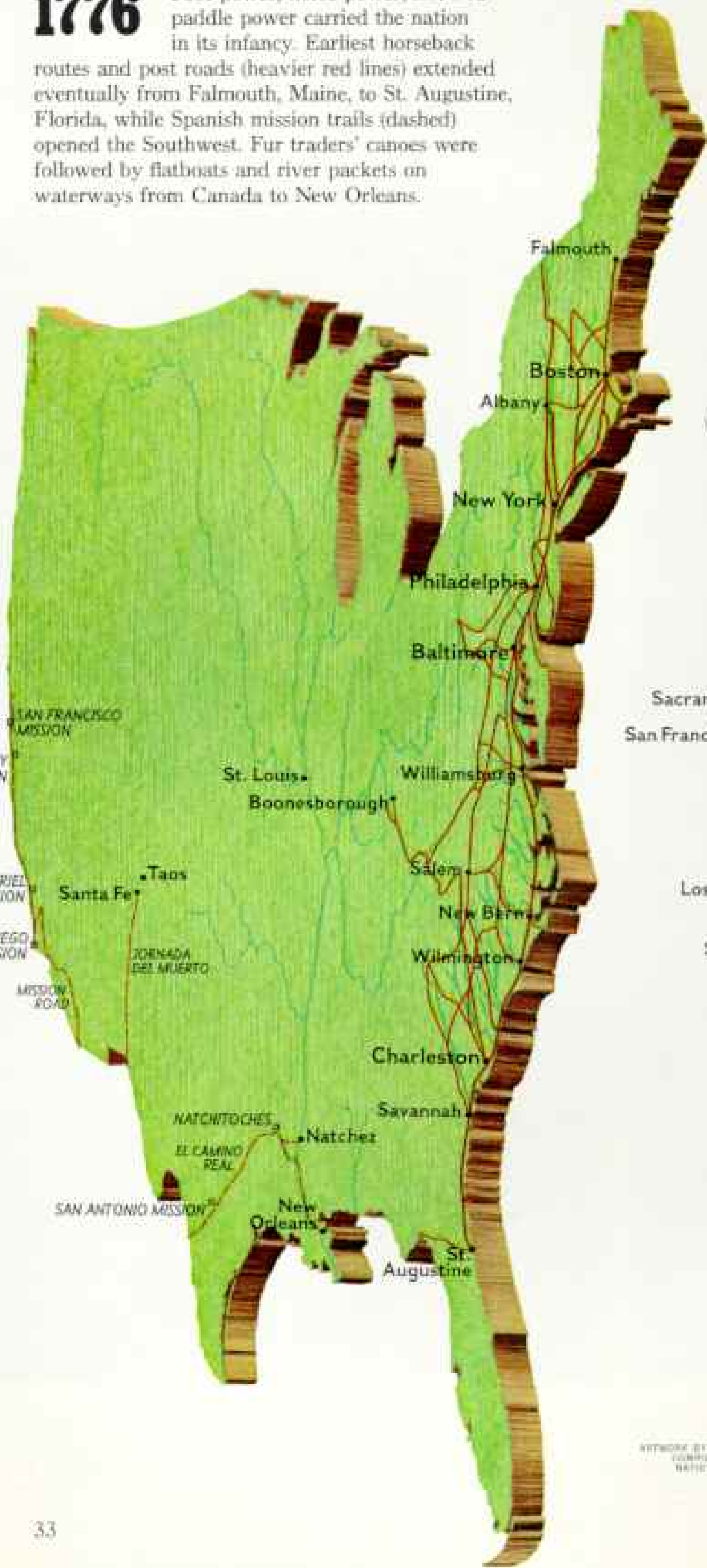
CEMETERY IN CALIFORNIA; NATIONAL GEOGRAPHIC PHOTOGRAPHER JAMES P. BLAIR



Even the dead make their claim to the land. Head-to-toe tombstones bespeak the inescapability of congestion. Will the answer be high-rise mausoleums?

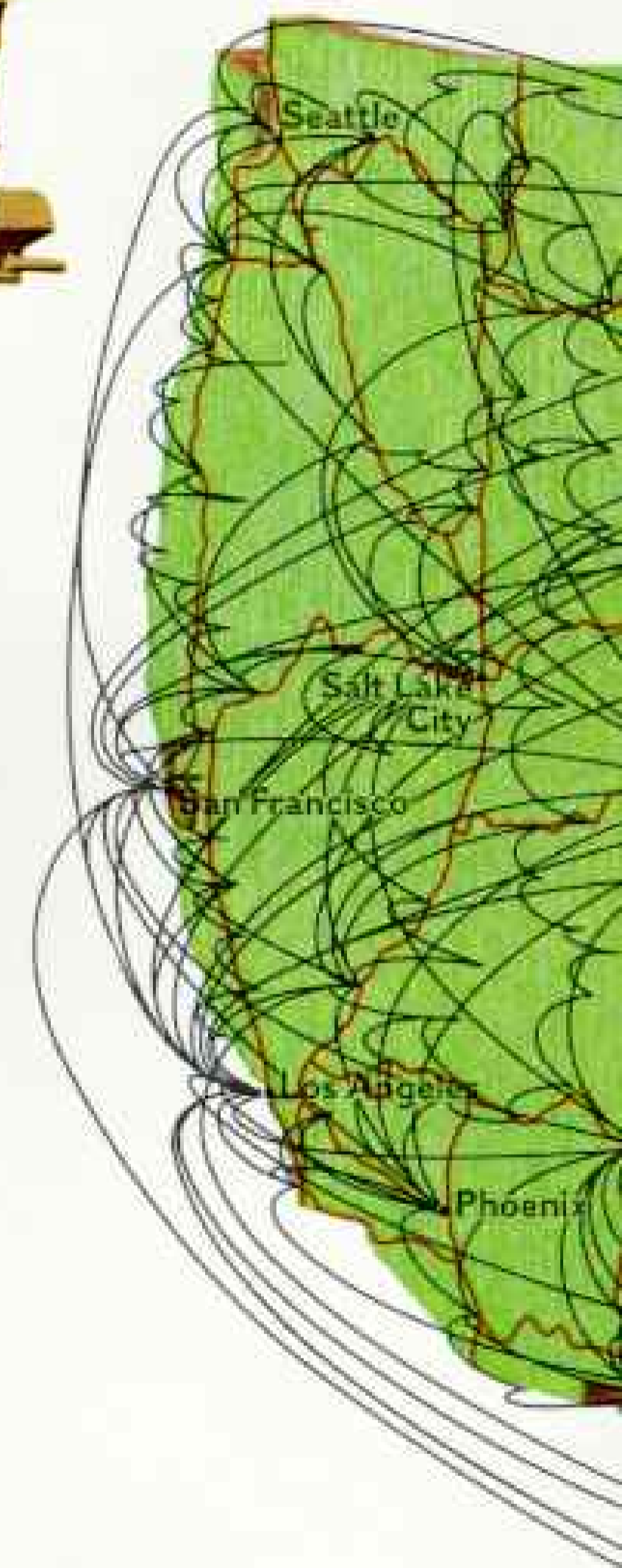
1776

Foot power, horse power, sail and paddle power carried the nation in its infancy. Earliest horseback routes and post roads (heavier red lines) extended eventually from Falmouth, Maine, to St. Augustine, Florida, while Spanish mission trails (dashed) opened the Southwest. Fur traders' canoes were followed by flatboats and river packets on waterways from Canada to New Orleans.



1876

By the Centennial year, eastern rails and western trails had stitched together vast distances. Gleaming rails (gray lines) linked the Atlantic and Pacific when the golden spike was driven at Promontory, Utah, on May 10, 1869. Earlier, the pony express had carried the mails, and pioneers had followed covered-wagon trails west (dashed red lines). Cattle trails (dotted) took Texas herds to railheads in Kansas and Colorado.

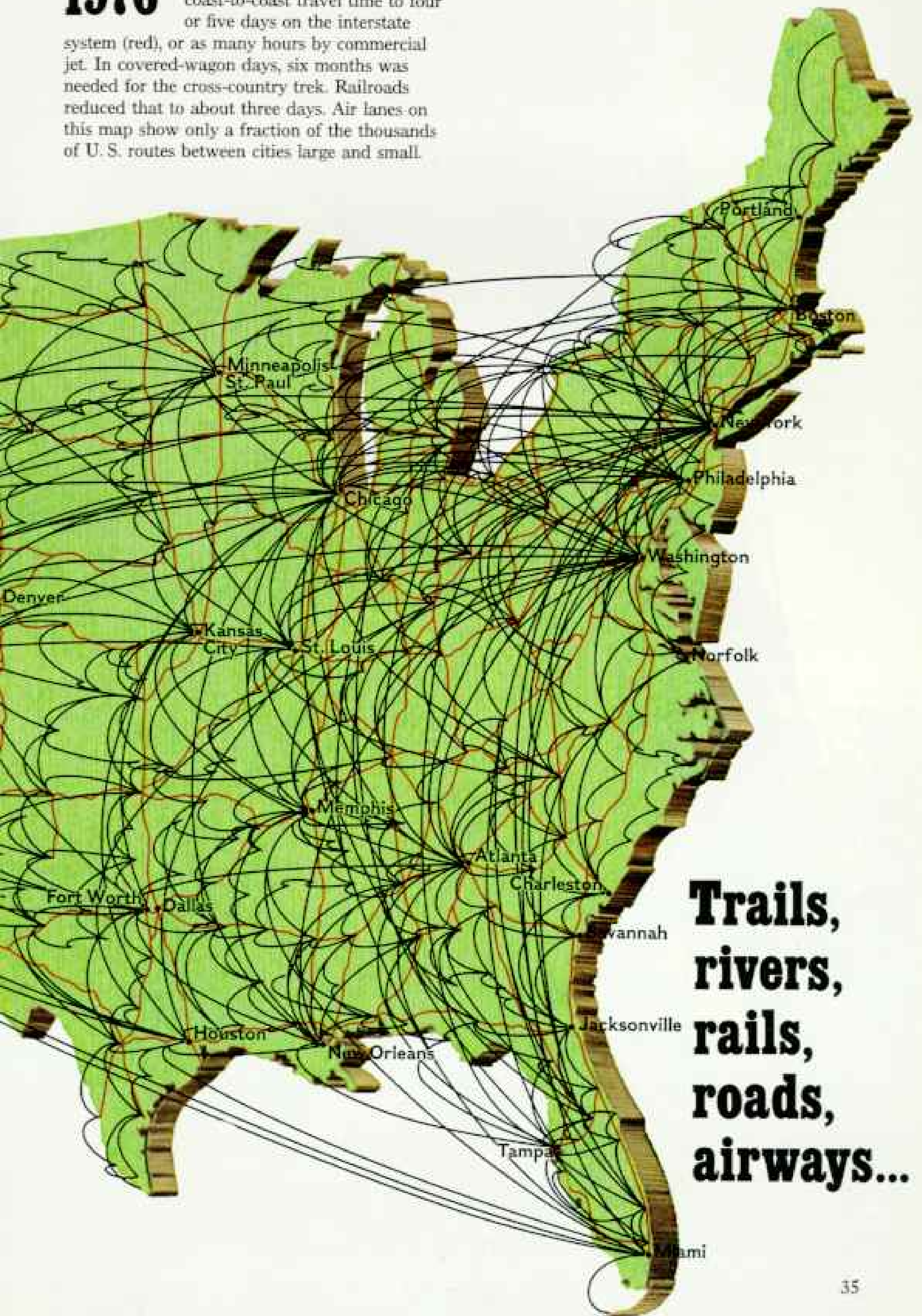


FROM CANOE TRAILS to highways in the sky, the paths across the United States have been as varied as our history. National expansion has marched hand in hand with leaps ahead in transportation technology. Maps showing major transportation networks in 1776, 1876, and today dramatize the physical binding together of a far-flung land and a people forever on the move.

BYWORK OF WILLIAM H. BERRY AND TED ZIEGLER
CONCEPT BY GREGORY A. WITKOWSKI
NATIONAL GEOGRAPHIC ART DIVISION

1976

The age of speed has shrunk coast-to-coast travel time to four or five days on the interstate system (red), or as many hours by commercial jet. In covered-wagon days, six months was needed for the cross-country trek. Railroads reduced that to about three days. Air lanes on this map show only a fraction of the thousands of U. S. routes between cities large and small.



**Trails,
rivers,
rails,
roads,
airways...**





Burned-out streets and blighted lives in an arson-devastated, drug-plagued section of New York City's South Bronx seem a fulfillment of God's Biblical warning: "I will lay your cities waste. . . ." But this urban desolation is man's work. Tax laws and zoning regulations that inadvertently make it more profitable to set fire to a run-down building than to restore it for human habitation give incentive to the arsonist's torch, thus compounding the tragedy of our inner cities—crucibles of all that is worst in American land use.

But even here an aroused citizenry fights back. Garishly painted mural (above) warns traffickers who grow rich on the desperate cravings of drug addicts. A young American (right), though he must live in such a corrosive environment, skylarks in the street. Will the American dream include him too?







(Continued from page 25) probably not. The county wants to preserve the land for farming.

Driving northwest, I'm never far from corn and soybeans and bales of hay. Minnesota seems half fields, half forests. I cross the Mississippi to the heart of Minneapolis and walk into Crystal Court. Wow!

It's an indoor plaza, eight floors high, glass- and Plexiglas-roofed, with trees, shrubbery, and shops selling office supplies, paintings, cheeses (left). Up at the second-floor level, glassed-in skyways—air-conditioned now, heated in freezing winters—connect to ten more blocks of shops and offices. It's a show-piece of downtown regeneration.

New urban centers revitalize the aging hearts of cities

An urbanologist has estimated that in our big cities the typical central building site has been reused at least four times since 1800. Minneapolis started late. At this meeting of the Minnesota and Mississippi Rivers, there were fur trappers until 1820, loggers and saw-mills by 1850, flour mills by 1870. . . .

A central site was cleared in 1969, to be rebuilt in the spirit of architect Victor Gruen; glassy new buildings, a pretty mall for pedestrians, lots of parking. That's what he envisioned for Fort Worth in 1956. It became a prescription for dying downtowns across the nation, with financial support from the Federal Government.

From the 51st floor of the new IDS Tower I look down on redeveloping Minneapolis, the new Institute of Arts, the new Orchestra Hall. A third of the immediate area is parking lots—more than were dreamt of in Gruen's philosophy.

And there's the 100-acre Cedar-Riverside project near the University of Minnesota, intended to house 30,000—a planned town within a town, in place of unplanned sprawl.

Back to the great indoors, shoppers flock to the climate-controlled, glass- and plastic-roofed Crystal Court in downtown Minneapolis. With shops, restaurants, a theater, and a hotel, the "people center" is one of a new breed of business and cultural complexes intended to revitalize inner cities.

Loans for 54 million dollars were guaranteed by HUD, the U.S. Department of Housing and Urban Development. Federal commitments and outright grants—subsidizing developers, builders, tenants, and homeowners over the past quarter of a century—total nearly 120 billion dollars.

But construction has been stalled by litigation; the Cedar-Riverside Environmental Defense Fund objected to too much density.

Near Jamestown in North Dakota, the state most reliant on farming, I stand on the edge of the Great Plains. This is the region of the prairie potholes, where farm and wildlife interests clash.

Potholes for ducks or prairie to be plowed?

Potholes measure a tenth of an acre to several hundred acres;

some are wet all year, but most hold water only during two or three months—a few inches to several feet deep. To the biologists of the U.S. Fish and Wildlife Service they are things of beauty, full of nourishment for nesting ducks.

This glaciated pothole region—ranging from Minnesota through the Dakotas and into Canada—produces a major portion of all the waterfowl in North America. I see coots, rails, teals; a ruddy duck, a pied-billed grebe; canvasbacks; a white pelican.

A biologist says that farmers plow up what's left of the mixed-grass prairie and drain the potholes. "It's the old Judeo-Christian ethic, you know—man has dominion over nature, you tame it and subdue the land. That and the free-enterprise system. Every farmer feels he can do with his land whatever he wants.

"We need a strong land-use law; some of the hilly areas here should never be plowed, or erosion will take the topsoil off. They should be left for grazing."

The farmers I meet are grandsons and great-grandsons of Swedes, Norwegians, Germans who arrived in the 1870's, when this was the end of the Northern Pacific Railroad.

The Federal Government had the public domain surveyed into squares, in a grid pattern such as proposed by Thomas Jefferson. Each section is a square mile, 640 acres. To encourage railroads to build tracks out to

MOUNTAINS in New York City? Plains in the Rockies? In this computer-drawn depiction of American population growth, densely peopled areas become mountains and sparsely settled areas show



1876

Century-old Republic shows a populated northeastern seaboard and a sprouting populace around San Francisco. Pushing the frontiers before them, some 46 million Americans occupied most of the country east of the Great Plains.

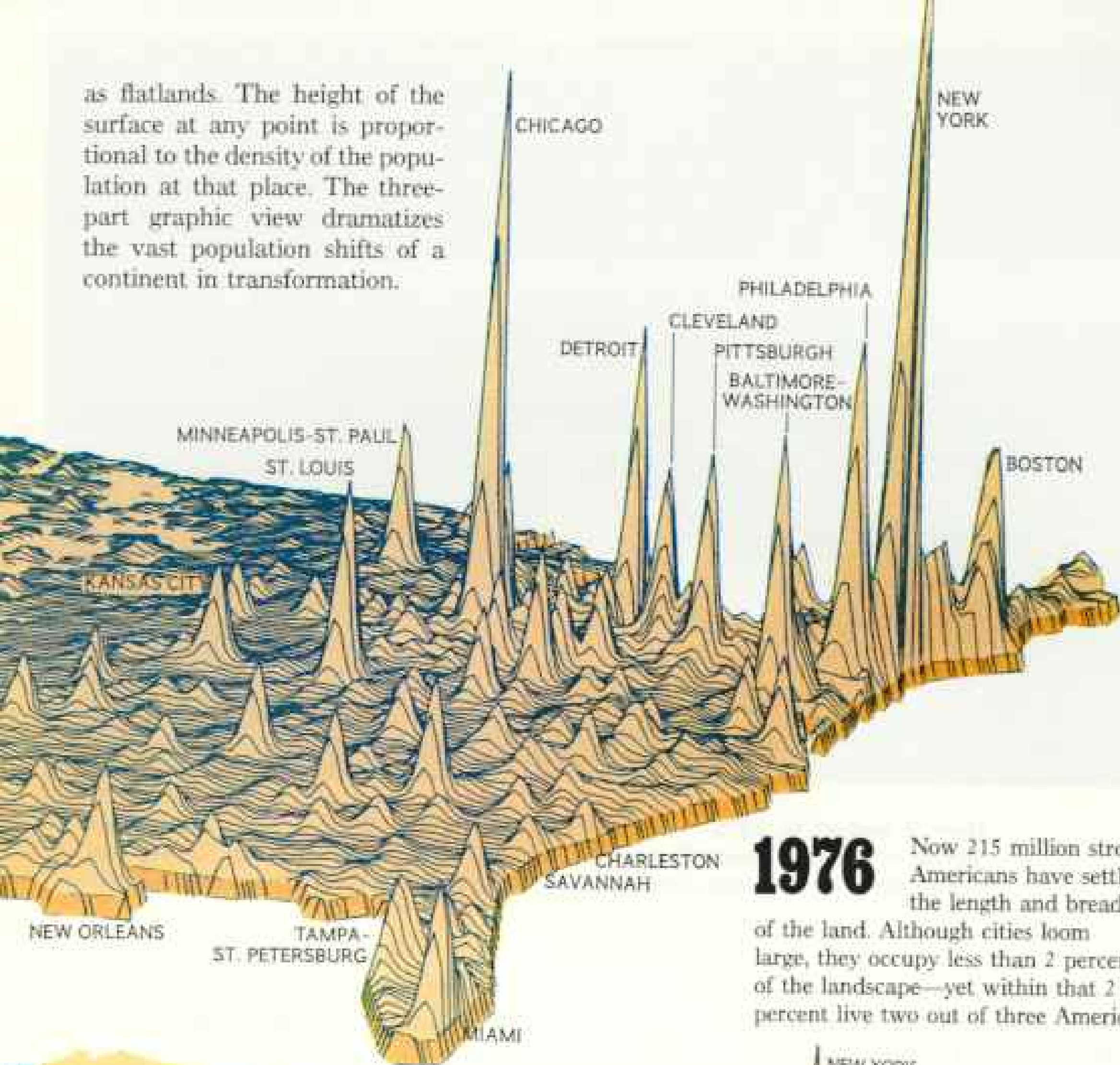
SAN FRANCISCO



1776

When the nation was born, nearly all of its estimated 2½ million citizens lived within 200 miles of the Atlantic seaboard. One small isolated area, centering in Kentucky, was opened to settlement in the 1770's by Daniel Boone.

as flatlands. The height of the surface at any point is proportional to the density of the population at that place. The three-part graphic view dramatizes the vast population shifts of a continent in transformation.



1976 Now 215 million strong, Americans have settled the length and breadth of the land. Although cities loom large, they occupy less than 2 percent of the landscape—yet within that 2 percent live two out of three Americans.



Settlers, sodbusters, cityfolk



THESE COMPUTER MAPS BY THE LABORATORY FOR COMPUTER GRAPHICS AND SPATIAL ANALYSIS, HARVARD UNIVERSITY, ARE BASED ON CENSUSES CLOSELY RELATED TO THE NATION'S ANNIVERSARIES: 1774 (THE FIRST TO BE TAKEN), 1870, AND 1970. THUS, THE BOTTOM MAP SHOWS A SLIGHTLY GREATER DENSITY OF POPULATION THAN ACTUALLY EXISTED IN 1774, AND THE OTHER TWO A FRACTION LESS.



OHIO POWER COMPANY

How it looked in 1972... Four-year-old photograph shows a nearly worked-out portion of the Ohio Power Company's sprawling Muskingum strip mine. Hardly had mining stopped when teams of reclaimers moved in to restore the land to constructive use.

nowhere, they were given title to every other section, out as far as 40 miles on each side. The Northern Pacific alone received 40 million acres, almost equal to all of North Dakota. Newly arrived families would pick an empty quarter section and set to work. If they stuck it out for five years in the loneliness and the wind, they could get title to those 160 acres under the Homestead Act of 1862.

That's how the Government promoted the settlement of public land. And why North Dakotans still discuss land in terms of quarter sections. I listen to a man who farms eight quarter sections, which is typical around Jamestown, and has dozens of potholes in assorted sizes; he calls them sloughs. "Those people who want to keep everything unchanged, those preservationists, they don't have to make a living off the land, they have a regular salary coming in."

To grow as much wheat as he can, he uses big machines that are hard to maneuver around potholes. So-called grain drills seed a wide strip at a time; I saw 54-footers and an 84-footer. They cost \$500 a foot, plus

\$20,000 to \$50,000 for a tractor to pull them. No wonder quite a few farms are heavily mortgaged; but as land values go up, a farmer can borrow more—as long as he gets the most use out of his machines.

Now I've crossed the wide Missouri and eastern Montana into Wyoming, into another world. I've crossed the 100th meridian, which runs through the Dakotas, Nebraska, Kansas, Oklahoma, and Texas. It divides our country into East and West, a line of extraordinary significance to man and beast. Beyond, it's a thousand miles of dry land to the Pacific. It's the land of the rancher.

In Maine, annual precipitation is 35 to 50 inches. In the corn belt, 30 to 40; around Jamestown, North Dakota, 14 to 20. They say it's desert when there's 10 inches of rain or less. Here in Wyoming's Shell Valley it's 5 to 9. How can one make a living from such land?

Critical line between enough moisture and too little



DAVID BRILL

... And how it looks today. Recontoured and replanted to meet latest state laws, the devastated landscape regains life as potential pastureland. Parks, lakes, and woodlands spread over other mined lands nearby. Meanwhile (background) the stripping goes on.

I ask a rancher named Dave how many acres he's got. He winces. He knows precisely, but it's not that simple. He owns acreage along Shell Creek fed by runoff from the Bighorn Mountains. This entitles him to water rights from the State of Wyoming. He takes a strictly limited number of gallons from the stream and irrigates to grow feed grains, enough for a thousand cows for five months.

He also has a federal allotment from the Bureau of Land Management that allows him, for a fee, to put his cattle on 25,000 acres of the publicly owned badlands nearby; it has just enough desert saltbush to sustain his cows another four months.

For the remaining three months, he'll take them to the Bighorn Mountains. He owns pastureland up there, and he also holds a grazing permit from the U. S. Forest Service.

Dave pushes his little Piper Super Cub out of a shed to give me a look from the air at the land that is his life. I see the precious irrigation water sprinkle on hard-won greenery. And now the dry soil—arroyos, mesas, and eroded cliffs, vast flat stretches with dusty

clumps of brush. And miles of barbed wire. Some years only two inches of rain falls here.

Few Easterners realize how much land out here still is in the public domain. Roughly a third of Colorado, Montana, Washington, and New Mexico. Half of Wyoming, Arizona, Oregon, California. Two-thirds of Utah and Idaho, nearly nine-tenths of Nevada. Most of it is much like this—a bit of irrigation, a lot of desert, forest, and mountains.

Dave banks the plane sharply. "Look, an old pony-express trail . . ." He says he put in another ten miles of fence, at \$1,800 a mile. What's this? Two trucks and a front-end loader, big piles of gray earth. "They've got a claim to mine bentonite"; it goes into oil-drilling mud, insecticides, lipstick.

We circle a ranch in the valley. "A fellow from the East. Thought he could run 200 cows. He can't." Ahead rise the pines and meadows of Bighorn National Forest. Up here there's 10 to 40 inches of precipitation a year—and grazing, logging, camping, dude ranches, skiing, and hunting in season. That's the federal multiple-use concept.



Dave's dad used to be a state senator; he tells me people are a little resentful of the Bureau of Land Management and their new-fangled regulations. "They used to have two fellows and a secretary, now they have 35 people in the district office at Worland..."

Later I ask the BLM district manager about it, and he says he could use more people than that. The idea once was to dispose of the public land to private owners, but now the BLM holds on to it, to manage it for maximum public benefit. And the National Environmental Policy Act of 1969 requires that federal decisions that may affect the environment must first be studied for their impact.

"Important decisions may need detailed environmental impact statements, up to a thousand pages, so we've got experts." A geologist, a biologist, a recreation planner, an archeologist, two botanists...

How's it working? "Well, we make better decisions. Everything's documented, the public can see what's being done and why..."

As I leave, I note what's in the works. Worland wants a rifle range. OK, leased at 25 cents an acre. Motorcyclists want a place to race. OK, fee based on gate receipts, and they must clean up afterward. Power company wants right-of-way. We'll see.

At the Big Horn County Fair, ranchers' kids preen their 4-H steers and lambs with hair spray before the auction. Bankers and merchants pay big prices, to please kids and parents. A banker sitting next to me shakes his head. Beef was scarce, he tells me, then came a glut. "It costs \$150 to \$200 to produce a calf, and for a while they brought less than \$100! If an outfit has no other income, that's bad. We see land going into investors' hands outside the state."

Before I leave Wyoming, Dave shows me some new houses going up, where a neighbor subdivided some land. "People want houses in the country," he says, "schoolteachers, power-company people. They pay \$1,500 or \$5,000 for an acre, put a picture window on it, it's worth it to them. If I buy an acre and it's 'ten-acre land'—it takes ten acres of it to sustain a cow for a month—it's worth \$25. Through this subdividing, society is telling me my days in this valley are numbered."

There's a bigger threat to his way of life. It's coal, and it fuels a perplexing land-use war, ignited by the energy crunch.

Coal men look to stepped-up production in Kentucky, West Virginia, and Illinois, but even more in the West. That's where more than half of the country's known reserves lie—and of the 235 billion tons in the West, 75 percent is in North Dakota, Montana, and Wyoming, half within 150 feet of the surface!

Orders are out for gigantic strip-mining machinery. What's coming, warns a federal-state study, are population increases, social systems strained and altered. Imagine 6,000 newcomers pouring into a town of 400...

The Decker Mine in Montana (pages 48-9, 50-51) sends 100-car trains to Chicago and Detroit—170,000 tons weekly, to burn for electricity. What is planned is to burn more coal right here, in dozens of plants, and send the electricity out. And to build even bigger plants, to turn coal into gas and liquid fuels.

Farmers, ranchers, and environmentalists are angry. The *(Continued on page 49)*

Nightmare choice: overnight wealth or well-loved land?

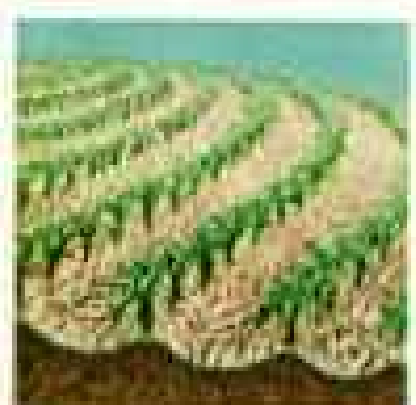
Using the lay of the land, a farmer in Wyoming husbands his soil by contour plowing. Parallel furrows across the slant of the land keep the rainfall and fertilizers in the dry and sloping earth and help prevent erosion—the cause of the scars on the hills behind. Now, in many parts of the country, farmers are going a step beyond contouring in an effort to save their topsoil (right)—a practice that scientists say could safeguard the soil for a hundred generations.



36 years



104 years



2,224 years

What is the life of eight inches of topsoil? The years above tell the time span allotted under straight-line plowing, contouring and terracing, and a new concept of drilling seeds into untilled, mulched, and contoured terraces.





JIM BRANDENBURG (ARROW)



Dust bowl in the making? Forgetting the hard lessons of the past, some midwestern farmers are cutting down trees that served as windbreaks, and plowing more land to increase crops and hence profits. Windbreaks like these on a North Dakota farm (left) were widely planted after the 1930's dust-bowl days. Now the land may once more be blowing away. Layered snow and blown topsoil—"snirt"—(above) collect along a Minnesota roadside. When the snow melts, the dust may fly again—and with it the land's fertility. A biologist (right) shows how parched topsoil is easily gone with the wind.





Moving the land around, a convoy of 100-ton trucks rumbles into the huge Anaconda copper pit, which has literally eaten into the city of Butte, Montana. Like mini-volcanoes (right), explosions loosen coal in the nation's highest-yielding coal mine, at Decker, Montana. The mine ships more than nine million tons a year to midwestern power plants.





NICHOLAS DENORE III (ABOVE)



(Continued from page 45) strippers will ruin the land, they say; the power plants will pollute the clean air. Gasification and liquefaction plants will be even worse, since they demand water for hydrogen. It'll take a gallon of water for every six pounds of coal; it'll dry up the West!

Some of the coal is owned by Indian tribes and a lot by railroads, such as the Burlington Northern, which received those enormous grants of land and subsequently obtained even more. But most western coal still belongs to the Federal Government; since 1916 homesteaders got title to surface rights only.

Coal, like oil and oil shale, potassium, sulfur, and phosphate, is a leasable mineral—to mine it you need a lease, and you pay royalties. On the other hand, so-called hard rock or metallic minerals—gold and silver; copper, zinc, and lead; titanium, chromium, and gems—fall under the remarkable Mining Law of 1872. Anyone may prospect for these on 140 million acres of national forests and file a claim at the county courthouse. Some 1,600,000 such claims are on file (and on other federal lands, many more).

Prospectors can file at will to mine the public's land

The prospector may then mine as much as he wishes—without paying the Federal Government a cent of royalty. He may also file for a deed, to make that public land his property! Attempts to change this law meet fierce resistance from western legislators.

The Government has leased out much of its western coal and wants to lease out more. Some of the biggest leaseholders are coal companies belonging to big oil concerns—Exxon, Continental Oil. "Landmen" have been pressuring farmers and ranchers from North Dakota to New Mexico, leasing surface rights and buying water rights.

Enter the Environmental Policy Act, as interpreted by federal judges. Any citizen whose enjoyment of the environment may be impaired by some federal action can demand that an adequate impact study be made first. The Sierra Club sued the Department of the Interior, charging that environmental studies of the coal regions were too limited and demanding a halt to federal coal leasing. The





Energy: a great land gobbler. As the world seeks alternatives to oil, the realization dawns that producing energy requires land—lots of it. While oil wells and deep-mined coal disturb little surface land, strip mining of coal by its very nature scalps sizable tracts, as demonstrated by Montana's Decker Mine (left, below).

Less publicized is the enormous acreage required for some nuclear power plants. Heated cooling water from the Turkey Point Plant near Miami (left, above) circulates through 168 miles of canals before reuse.

One possible land-saving solution: the gasification of coal in situ—that is, by converting the coal into gas while it is still deep underground, thus disturbing little surface area. Jet of coal gas in a laboratory (above) augurs the potential boon to come.



Mobile homes, Indian style, sprout amid a jam of cars and campers at the annual fair and rodeo on the Crow Reservation in Montana. Tepees house Indians from dozens

U. S. Supreme Court will ultimately decide.

So, for now the great coal expansion is curtailed, and a coal-industry lobbyist tells me he's fit to be tied: "The ecofreaks are running amok, and our Government and Congress can't make up their minds. I'm losing faith in the system." He wonders about a socialist conspiracy.

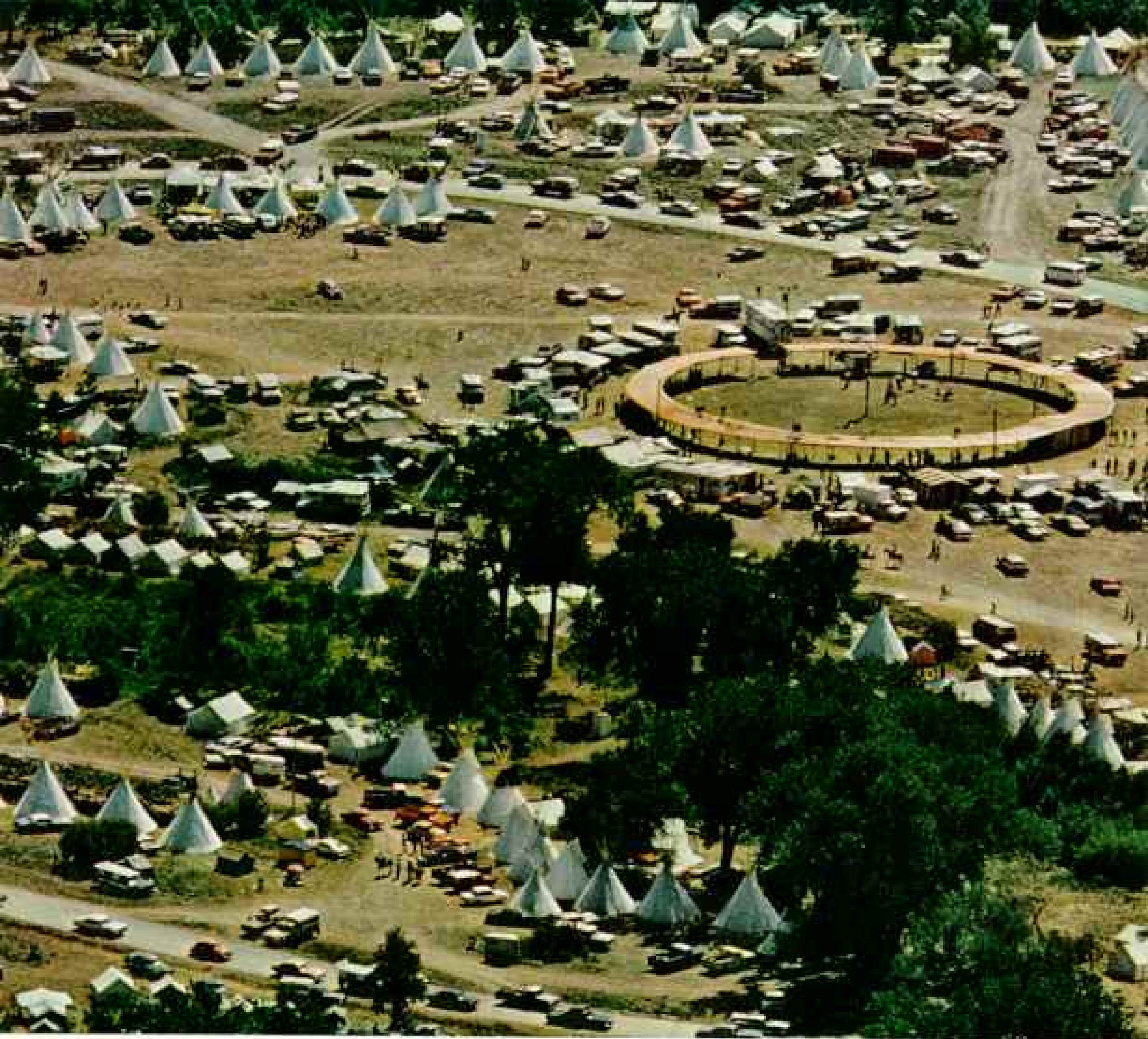
Early one day I charter a plane and fly over the Four Corners Power Plant, next to a strip mine near Farmington, New Mexico. Dark clouds billow from two tall stacks. We fly on and look back; now the clouds are white. It all depends on your point of view.

Some 180 miles westward, near Page, Arizona, steam pours from squat cooling towers

of the Navajo power plant; its three stacks rise 775 feet; the sulfur dioxide and nitrogen oxides coming out are invisible.

Forty miles north in Utah—across Lake Powell, formed by the Glen Canyon Dam on the Colorado River—lies a much-disputed plateau: the site of the projected Kaiparowits mine and power plant. It's to be the biggest in the West. Kaiparowits is stalled.

Environmentalists charge it would foul the air over precious parts of the public domain—the Glen Canyon National Recreation Area, Escalante Wilderness, Bryce Canyon. Power-company engineers say no, it wouldn't. Will EPA, the Environmental Protection Agency, which enforces the Clean Air Act of 1970,



of different tribes from sixteen states. Principal topic at last year's powwow: how best to control for Indian benefit the billions of tons of coal underlying tribal lands:

issue a construction permit? President Ford requests a lowering of certain of the act's air-quality standards. Congress is debating. (Several months later, two of the three power companies backing the Kaiparowits project dropped their plans; the third still hoped to go forward eventually.)

Back in Montana, near Hardin, it's time for the annual fair on the Crow Reservation (above). I see visitors of many tribes, lots of feathers and beads, kids riding bareback amid pickup trucks and teepees, drumming, chanting, dancing, politicking.

In a trailer, the Shell Oil Company shows a movie—how Earth Mother put down coal for her children, who can now benefit with

income and jobs. Shell people say they'll reclaim all the land they strip, it'll be nice. They offer free soft drinks.

A young Crow tells me the tribe signed a coal lease with Shell at 17½ cents a ton, but they've been ripped off, the tribe should make at least ten times that. Shell says they now offer more. But the Crows say they are still going to court, to try to break the lease.

I meet the chairman of the Tribal Council. "Once we mess up our land," he says, "we have no more. We're not like white people who just move on. We want to work out something reasonable, but we must first set up a land-use zoning code, and a strip-mining and reclamation code."

By early autumn I am in California—on a backcountry trail in Yosemite National Park, where the granite face of Hetch Hetchy Dome rises 2,300 feet in the High Sierra. Over in Yosemite Valley, below El Capitan and Half

Conservation or preservation: Did John Muir thunder in vain?

Dome, campgrounds and lodges bustle, and conventioners throng the Ahwahnee Hotel. But here it's quiet. A rattlesnake relaxes in the afternoon sun.

A nationwide controversy focused right here early in this century: Should San Francisco, 150 miles away, be allowed to dam the Tuolumne River and turn the Hetch Hetchy Valley into a reservoir for water and power?

Certainly, said Gifford Pinchot for the conservationists. Nature must be managed scientifically, to supply our practical needs; to say otherwise would be sentimentalism.

John Muir, for the preservationists, said never! Nature should be left untouched by commercialism, to refresh the human spirit!

Muir expressed ideas whose time had come. The wild frontier was gone for good, the cities were growing more crowded; to many, the wilderness began to look idyllically attractive. But after years of wrangling, Congress voted for the dam in 1913.

So here's Hetch Hetchy Reservoir, now 300 feet deep. Did John Muir thunder in vain? The place looks refreshingly wild to me; apparently to quite a few others too: Chunky imprints of Vibram soles are as plentiful on the trail as cow pies on the Wyoming range.

I sit and savor the solitude. A dry leaf coasts by, scratching across granite. Here

comes a backpacking couple. I forgot my copy of Muir's Yosemite book, so they give me theirs. They say they're from Los Angeles, having a great wilderness experience.

And later, in San Francisco, I find that the Sierra Club, which Muir founded, is prospering. Membership's above 150,000; they're moving to larger quarters.

Here in California I'm struck by the gall of its 19th-century land-grabbers. Like Henry Miller, a butcher from Germany who wound up with more than a million acres. Here's how he got a lot of dry grassland in the San Joaquin Valley, thanks to the Swamp Lands Act of 1850: It enabled land under water to be acquired cheap by anyone who would drain it. To claim his land, Miller swore he'd crossed it in a boat, and so he had. In a dinghy on a wagon pulled by horses.

Much dry California soil became fine farmland, thanks to the Reclamation Act of 1902. That act set up the U. S. Reclamation Service, now the Bureau of Reclamation, to build dams and irrigation systems in the 17 semiarid Western States, to encourage settlement by supplying small family farms with inexpensive water. The bureau's achievements are stupendous. I've seen Hoover Dam and Lake Mead, regulating and storing Colorado River water, and the All American Canal, carrying it to California's Imperial Valley, a former desert now dishing up a bonanza in carrots, melons, lettuce, tomatoes.

True, the benefits sometimes flow to big corporations whose main business is in other fields. For them, big farming can be an important tax shelter. It's often said that in today's agriculture only a big farm can efficiently produce food at reasonable prices. It all depends on whom you ask.



In California, a cooperative of 29 families near Watsonville—they're proud to call themselves Chicanos—does all right with 176 acres of strawberries. With some crops, in fact—says the U. S. Department of Agriculture—the little farmer is likely to produce more profitably than the giant.

Chicanos in the Central Valley would like to buy from big farms a little more land, reasonably priced; and according to the 1902 law, landowners receiving Bureau of Reclamation water are supposed to sell all land in excess of 160 acres to farmers who will live there, at prices reflecting the value of the land before irrigation came. Some big farms are indeed selling—but to whom, and how, makes for tales reminiscent of the old land-grab days. Chicano spokesmen have been discussing this with a U. S. Senate committee.

I'm heading eastward across the southern

Air conditioners bring a boom to the sun belt

United States now, in sunny lands where air conditioning facilitated large-scale settlement only in the past 25 years or so. In that time, the population in this southern "sun belt"—15 states, from California to the Car-

olinas—rose twice as fast as in the rest of the country. In Arizona, by 197 percent.

North of Williams, Arizona, on the highway to the Grand Canyon, I stop at a real-estate office. Not much around but brush and dryness—no, there are stakes and street signs too. Thousands of homesites, says the salesman. I see only a few scattered houses; their water has to come by truck.

"A healthy place to live," he says. "Clean

air!" Only \$40 down for more than an acre.

Could this be one of those notorious land gyps? In Phoenix I visit Arizona's new real-estate commissioner, who has promised to make it hot for land swindlers who sell the same lot to several people, for example, or forge sales contracts to bilk banks. "The legislature debated a land-use planning measure," the commissioner says. "It didn't pass."

What about the subdivision I saw? As far as I could find out, that promoter wasn't in trouble. I visit *him*. "Look," he says, "people come from cities where houses are on 30- or 40-foot lots. They see a piece of land 208 by 215! They walk on it, they kick the dust, they feel it, they think it's a kingdom!"

In his office, monthly payments roll in from all over the country. "Don't you see what it means to people who rent an apartment or live in a trailer? To be owners—landowners! It inflates their ego. We satisfy a great desire."

I guess so. All Phoenix seems to do the same. A new industrial center opens here, a new subdivision there. I see traffic lights amid cotton fields. Coming soon—Wild Horse Ranch houses, at 59th and Cactus.

This area has a desert climate, yet it's one of our big agricultural producers: cotton, oranges, onions; sugar beets in July, when in Nebraska they're ready in September; lambs in October, when in the Dakotas they arrive in May. A nice balance for the country.

Irrigation water comes from distant dams, but not enough. All Arizona has only 2,200,000 people but consumes more water than cities with a total population of 25 million. How is the deficit made up? Out of the ground.

Southeast of Phoenix I see a ten-inch pipe spurt water into an irrigation ditch. Great! "No—very bad," says the boss of the San



Leaving a trail of stillness, a helicopter spews pesticide over a Montana spruce forest. Since publication of Rachel Carson's classic *Silent Spring* in 1962, the national conscience has been aroused to the dangers of a chemical-saturated environment. Public outcry and legislative action have restricted or banned DDT and other potent insecticides. Yet the spraying of only slightly less lethal substitutes goes on—as does the accumulation of poisons in the land and in ourselves. Control of insect pests by sterilization or other biological means may be another answer. MICHAEL DEBONO III

Carlos Irrigation District. "The pump is surging, water isn't flowing in fast enough, there's air mixed in." The well is 900 feet deep and must go deeper: the water table falls five to ten feet a year. The land is subsiding. He shows me great cracks.

The Bureau of Reclamation plans to bring more water, pumped out of the Colorado above Parker Dam and into 300 miles of canals. That's the Central Arizona Project, to cost 1.5 billion dollars. Critics see disaster. They say there won't be enough Colorado water available, especially the way Phoenix and Tucson keep growing every month.

In west Texas, in Mentone, seat of Loving

Unfenced Houston spreads and spreads

County, there's a courthouse, a café, and a gas station. Population: 35. The county has 647 sections, or 414,000 acres. Population: 112, with 86 votes. The sheriff is also the tax assessor.

He says things are looking up because of all that natural gas.

We sit under a picture of Oliver Loving, who helped blaze the Goodnight-Loving Trail, driving longhorns from Texas north to Colorado (map, pages 33-4). He died of gangrene from a Comanche bullet in 1867.

Loving County is cattle country. Taxable value is only \$5 an acre, but if you've got a "hot spot," you can lease it out for exploration, for \$50 an acre a year. If they hit gas, you get 3/16ths; at \$1.85 per thousand cubic feet, and ten million cubic feet a day, that would be \$3,470 every day for you, \$13,130 for them.

I'm headed for Houston, heart of the world's largest petrochemical complex, which turns natural gas into fertilizer, rubber, vinyl. Houston (population 1,475,000) is one of the country's fastest-growing big cities. Four times as many people live here as did 35 years ago, and in that time this city—without zoning ordinances—grew sevenfold in size! It's the epitome of deliberate urban sprawl.

"We're unique," says an official. "Older metropolitan areas have problems of multiple jurisdictions. Take Boston—it's a little bitty city surrounded by other little cities. But we aren't fenced in; we have jurisdiction for miles around, so we can spread out. We let the marketplace follow the freeways. And as



Desert sands become a racetrack as motorcycles scar the land in a race from



NATIONAL GEOGRAPHIC PHOTOGRAPHER WALTER MEYERS EDWARDS

Barstow, California, to Las Vegas, Nevada. Cyclists extol the challenge of desert terrain, but environmentalists deplore the destruction of a fragile ecology.

we spread, we don't bunch up—we keep the density low. We like trees and open space.”

Houston just annexed another 3,660 acres, but only after developers had provided roads, sewers, and waste-treatment plants. “We don't want to pay out more than we'll get in taxes,” says the official.

A law professor explains how, until quite recently, a Texas developer could create a municipal utility district: He put two houses on his three hundred acres, he put his secretary and his foreman on the board with himself, and presto, they voted unanimously to issue municipal bonds, tax exempt!

What'll happen if those dinky little sewage-treatment plants don't perform? Or if EPA enforces the Clean Air Act? Houston's sprawl feeds on automobiles; any more cars, or petrochemical plants, and the federal air-quality standards will be further exceeded. But who would dare curb Houston's growth? That's a major political decision. . . .

Passing through Mississippi, I hear farmers

The
Deep South
booms—
in a
relaxed
way

say things much like what I heard in North Dakota. Equipment, land values, bank loans are up; “pretty soon Washington'll tell us what to do with our land.”

They're switching
now from cotton to

soybeans and rice in the deep rich soil along the big river; most sharecroppers left for the cities long ago—“tractored out,” they called it in the late 1930's.

In the hill country, it's cattle. And in the piney woods, next to logging, it's chicken factories! A cooperative provides feed, chicks, and transportation; the farmer furnishes land and labor. Result: 850,000 broilers a week, wrapped and outbound in refrigerated trucks. Eggs too, by the millions. Meanwhile industry moves down from the North, lured by relatively low wages, by relatively relaxed living. Mississippi relaxedly booms.

Near Braxton I visit an experimental mini-farm, as the young black man calls it. He hopes to show that winter tomatoes from vinyl greenhouses can be profitable. He works for the Emergency Land Fund, which seeks to prevent further loss of land by blacks.

In 1910, southern blacks held about 15

million acres, he says, some acquired after the Civil War when plantation owners were pressed to give former slaves 40 acres and a mule. Today, only about five million acres are in some 79,000 black-owned farms, and 60 percent of that land lies idle—because the owners are old, he says; because blacks find it hard to get loans.

How do blacks lose their land?

Poor management, the young man says. Or crooked lawyers. Through tax sales. Or partition sales: To many blacks, making a will seems like inviting death; when a man dies, he may have dozens of heirs. If just one can be persuaded to sell his share, then the new part owner can demand that the whole property be auctioned off. In such cases the Emergency Land Fund tries to step in as a buyer, to save the land for the blacks.

Conversely, land also plays a positive role in a black migration increasingly under way from northern cities back to the South. According to U. S. census figures for 1970-75, as many blacks moved south from the North as in the opposite direction. And a black mortgage banker had told me back in Chicago:

“A lot of the black middle class are fleeing the city, to get away from crime areas and poor schools. Also, better jobs are opening up in the South.” He said quite a few retired people with savings, and young people too, are moving to farms they inherited or bought in Mississippi, Alabama, Louisiana. . . .

I have followed the sun to southern Florida, to America's subtropical paradise. State maps point up two decades of land-use changes: cattle raising dramatically increased; so is sugarcane, cut by migrants from Jamaica. Most meaningful is the increase in housing: population up from 550,000 to 2,900,000.

Miles of mangroves, those natural nurseries for shrimp and crabs, have been filled in to make tens of thousands of acres of new waterfront property, where cabin cruisers proliferate. A big land boom began in the 1960's.

I drive north from Miami. Condominium towers as high as thirty stories crowd up to beaches barely fifty feet wide. But some stand unfinished, some empty. A big bust has hit the speculative condominium market. Unsold units are piled high in resorts all the way north to Ocean City, Maryland (pages 22-3).

A developer tells me he took a beating. Ten billion dollars' worth of real-estate investment

trusts are said to have soured across the nation, with some of America's biggest banks left holding the bag.

Down at Key West, at the southeastern extremity of our land, I watch the orange sun drop into the deep-blue sea. "If the money hadn't dried up, they would have built the hell out of the keys," says a planning and zoning official of Monroe County. "Now it's a whole new ball game."

Monroe County just adopted strict ordinances to control development, protect mangroves, proscribe honky-tonks. "Our people are split about it, but we'll live with it."

How did it come about? Federal and state pressure, he says; a new Florida law designated the keys an area of critical concern. But primarily it was local pressure—all those retired people. They go to meetings and form associations. Elected commissioners listen.

Now it's early December. I've parked the motor home and flown to the Olympic Peninsula, in Washington State—northwestern

corner of the contiguous 48 states. A local paper says 139.4 inches of rain fell here since the start of the year. On rocky Cape Flattery, overlooking the Pacific and the Strait of Juan de Fuca, I see caves carved by the foamy ocean. A foghorn booms, a gull lands near me.

En route back to Seattle I lose my way and stumble into a mind-boggling scene. A slope where once a forest stood lies flattened like some surrealist battlefield. From a seemingly endless expanse all trees are gone; left in the mist is a sea of stumps.

The timber industry calls this "even-aged management"; it means cutting *all* the trees in a given area. The industry claims it is the most economical way to harvest trees nowadays; that it's good for tree-growing too, especially for Douglas firs. All day I've seen trucks with logs barreling down to Port Angeles, to sawmills or to ships headed for Japan.

Environmentalists call it clear-cutting and say it's disastrous, a cause of erosion and silting of streams. This smoldering controversy



GEORGE W. HALL

From nowhere to nowhere, an unfinished interchange in San Jose, California, stands witness to an era of soaring costs and tightening tax revenues. Elsewhere, citizen opposition has slowed or halted encroaching highways.



Sprawled across cotton lands near Phoenix, Arizona, the planned community of Sun City houses more than 36,000 senior citizens. Homes radiate



from business centers; golf courses, parks, and man-made lakes provide recreation. Similar golden-age communities mushroom across the land.

Airport that isn't: A single runway and its taxi strips mark the site of a proposed jetport in the Florida Everglades that was stopped dead in 1970, after environmentalists convinced the courts that it might destroy the region's delicate ecology. The one finished runway is used today for training jetliner crews. An old Constellation (right) atop a nearby gas station was to have been a traffic-stopping cocktail lounge. Now it's a winged white elephant.



just burst into flame. A federal judge's decision banned clear-cutting in Monongahela National Forest in West Virginia. Will this affect all our national forests, which supply a quarter of our lumber for construction?

I'm pro-ecology. But statisticians tell us that of the 13,000 new families formed every week, only one in six can now afford the traditional detached house. Mobile homes account for a quarter of all new single-family housing. Major reasons are said to be rising costs of land—and lumber.

I have a final stop to make before I end my long journey—glorious Lake Tahoe, astride the Nevada-California state line 6,000 feet up in the High Sierra. It's an alpine lake with dazzlingly clear water, and the site of what may be shaping up into the classic land-use battle of our day.

Aside from Crater Lake in Oregon, there's nothing like it in the nation. And not even four car-hours from San Francisco Bay. So,

since the 1960's, more and more people have been coming, to the beaches in summer, to ski in winter, to gamble the year round.

Seventy percent of the Lake Tahoe basin is publicly owned—national forests, the Desolation Wilderness—and 20 of 70 lake-shore miles. Building has boomed on the private land—hotels, motels, vacation homes.

The lake is ecologically fragile, environmentalists say; despite millions spent for sewer systems, much of it federal money, the water is getting less pure. We must preserve this marvel for future generations!

A joint Nevada-California authority, the federally approved Tahoe Regional Planning Agency, or TRPA, decreed a new kind of land-use plan—derived from carefully established

Dilemma
of Lake
Tahoe:
How many
people can
use it?



carrying capacities for various zones of the land. The plan limits further development, through "downzoning"; it sets a maximum population of 310,000, instead of 800,000, as before. The fat's in the fire.

I hear a TRPA executive say: "A few years ago, downzoning was like burning the American flag. Now it's been upheld in federal court, it's morally correct."

A county supervisor answers: "Yeah, that's the bureaucrat talking, not an elected official. This is going to the Supreme Court."

A man from the Sierra Club and the League to Save Lake Tahoe offers some background: "Most people with property here don't live here and can't vote here. The local guy, the little fellow, sells appliances or repairs TV's or lays bricks—he came from San Jose or L.A. to get out of the rat race and go fishing when he likes, but he saw everybody making money, so his attitude changed and he wants to speculate too." Local business

doesn't want anything that'll keep people from coming, he adds. "And the county seats outside the basin get much of their tax revenue here; they want more people too—to them Lake Tahoe is a moneymaking machine."

The State of California, in which two-thirds of the shoreline lies, has an even tougher planning agency, the CTRPA. It decreed even further restrictions. The chairman says: "We counted 20,000 available lots with water, roads, and sewers, room for 64,000 people. We don't say no more subdivisions—we only say wait, build up this already subdivided land first." How long could that take? "We figure 11 to 18 years."

On the other side of the fence, a real-estate man speaks for the Council for Logic: "These extremist environmentalists argue from emotionalism, from false premises. The land is as pure as ever, the air quality is fine."

What's that haze? "Sacramento smog."

He talks of hundreds of cases of devastated

land values, of \$300,000,000 in damage claims now in the courts. He blames "the rich on the north shore, elitist snobs from San Francisco who don't want middle-income people here, but want the lake to themselves."

A rich north-shore man tells me that isn't true, he favors proposals for another 20,000 public campsites in the basin—but some merchants don't, they think campers don't spend enough money.

A man from an old south-shore family

nearly got rich. He sold 365 acres to a subsidiary of an oil company that hoped to build more than a thousand dwelling units. He was to receive \$1,190,000! But the company backed out. And CTRPA says only five residences can be built there now. This man sees a deliberate attempt to weaken local government. Ultimately? Dictatorship!

I drive around the lake. A big estate on the north shore has become a mass of condominiums. Would I like to rent one, for \$600 a

Caged by parking lots and visitor facilities, Old Faithful in Yellowstone National Park seems symbolic of the confrontation between wilderness and a leisure



week? The name of the place is Chinquapin—a Washo Indian word for a Sierra shrub.

Are there any Washos left? I meet some, across a mountain in Nevada. In her modest living room, a 70-year-old lady remembers summers on the lake with her grandfather who fished, with Washo families camped there. Does she think of Tahoe as Indian land?

"Why shouldn't I think so?" she says. "We were there before the whites. We never got paid for it, they just took it away."

Now I'm home, writing it all down. My wife says, "You sure put a lot of stress on money." I tell her I have to; it's so important in determining what's done with our land.

To be sure, the notion has been gaining ground that land is not just a commodity, to be bought and sold for maximum profit, but a limited national resource to be treated with respect; that we need a land ethic. Perhaps this will become the majority's view, embodied in law. So far it hasn't.

society. Yet only a short hike from here lie two million acres of wild magnificence that still beckon solitude-seeking visitors to the nation's largest national park.



Look what happened to the federal land-use bill, providing financial incentives for states making effective land-use plans in keeping with the land-ethic idea. It came to a vote last July before the House Committee on Interior and Insular Affairs. Lobbying had been fierce. In favor: mortgage bankers and planners, the League of Women Voters, Sierra Club, Friends of the Earth. Against: cattlemen, the American Mining Congress, National Association of Manufacturers, U. S. Chamber of Commerce. It was all over in

three minutes: 19 in favor—but 23 against!

"I've never seen so much grass-roots opposition in 15 years in Congress," said a Representative; he'd been in favor, then voted against. A writer from the *Washington Post* called it "the retreat from the heyday of environmentalism." A committeeman discerned "a new coalition of industry and labor, against anything that threatens jobs." Did that bill really threaten jobs? "It's enough that many people seemed to think so." Will it be tried again? "Maybe in 1977. A lot

America the beautiful—a land worth saving. Fearing the kind of rampant overdevelopment that mars the Atlantic Coast, the State of Oregon has



will depend on who's elected President."

How land is used, in short, is not so much the result of careful planning or high-minded philosophy. It's the upshot of financial and bureaucratic pressures, of compromises, court decisions, and politics. Above all, politics!

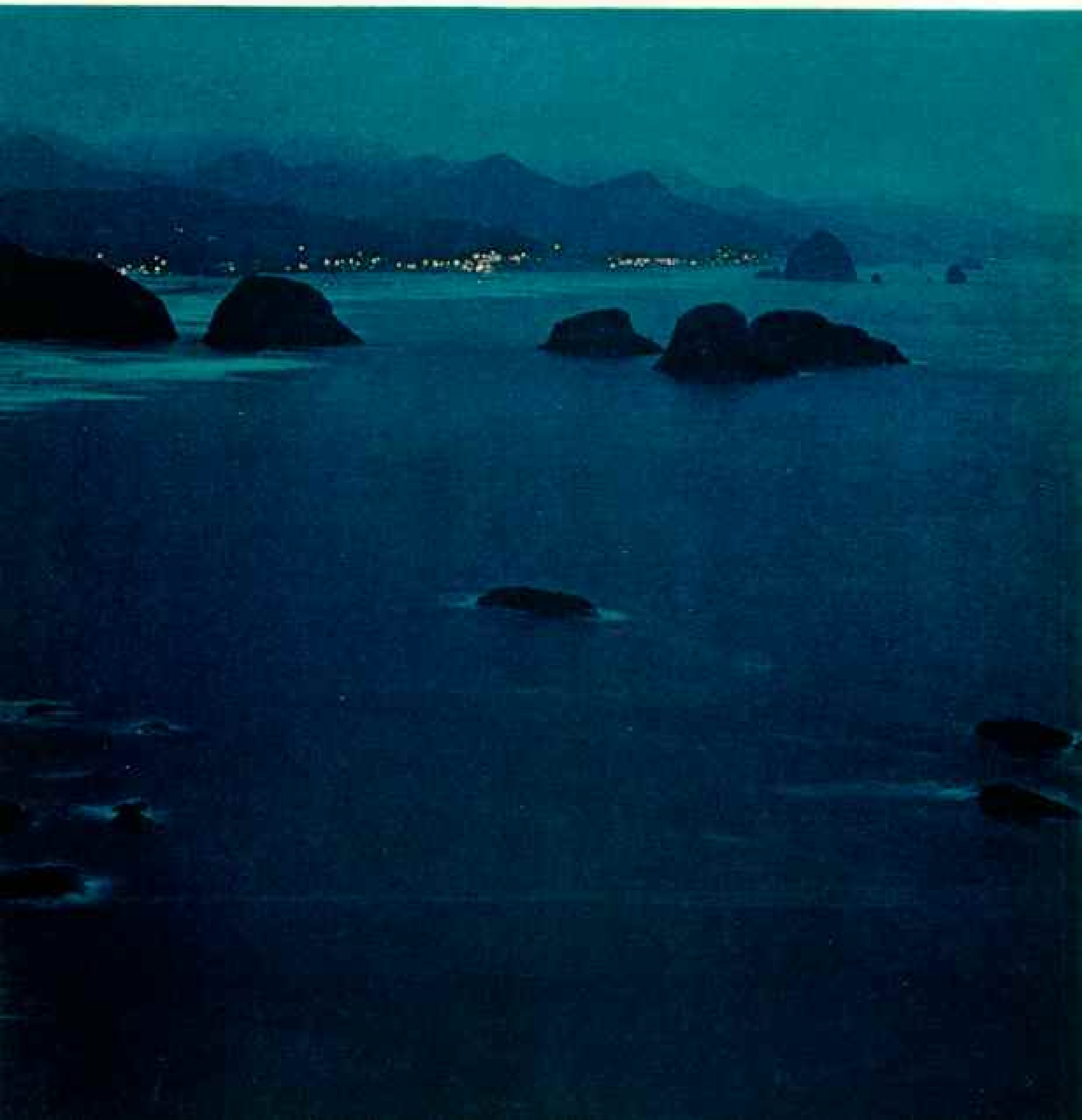
My wife says, "I didn't know you were such a cynic." On the contrary, I tell her, my experience made me more than ever an idealist. Even though all the bad things we hear about what's being done with the land are absolutely true.

"Then what are you so idealistic about?"

I tell her all the ups and downs I've seen, all the conflicting opinions I've heard—it all means our system works. True, it isn't self-operating, but we're lucky, we have the means to make it operate. When we pressure and complain and scream, we're playing our part, our proper role. Isn't that what makes our country so special in the world?

"I see what you mean," says my wife. "When you've finished your lunch, how about cutting the lawn?" □

declared nearly all its 362-mile Pacific coastline off limits to private developers. Scenic shores like this at Ecola State Park remain a legacy for all Americans.



Five Noted Thinkers Explore

ARE the suburbs dead? Will there be an economic resurgence of our inner cities? Will larger and larger units of government take more and more control over land use? Is mankind in general entering an era of greater affluence, of new and different attitudes toward land ownership? Is the oil crisis a blessing in disguise?

These were some of the questions posed when NATIONAL GEOGRAPHIC invited a group of famed thinkers to discuss possible outlines for the future. During the day-long seminar at Society headquarters (right), mind-stretching innovator Buckminster Fuller arranged Styrofoam balls to illustrate the rigidity of conventional assumptions. Panelist to his left is author Isaac Asimov and to his right is city planner Edmund N. Bacon. From the GEOGRAPHIC, writer Peter T. White muses with chin in hand; Editor Gilbert M. Grosvenor listens at lower left.

Opening the meeting, Mr. Grosvenor said, "We at the GEOGRAPHIC are pretty good at researching the past. But we're neophytes when it comes to probing the future. That's why you are here."

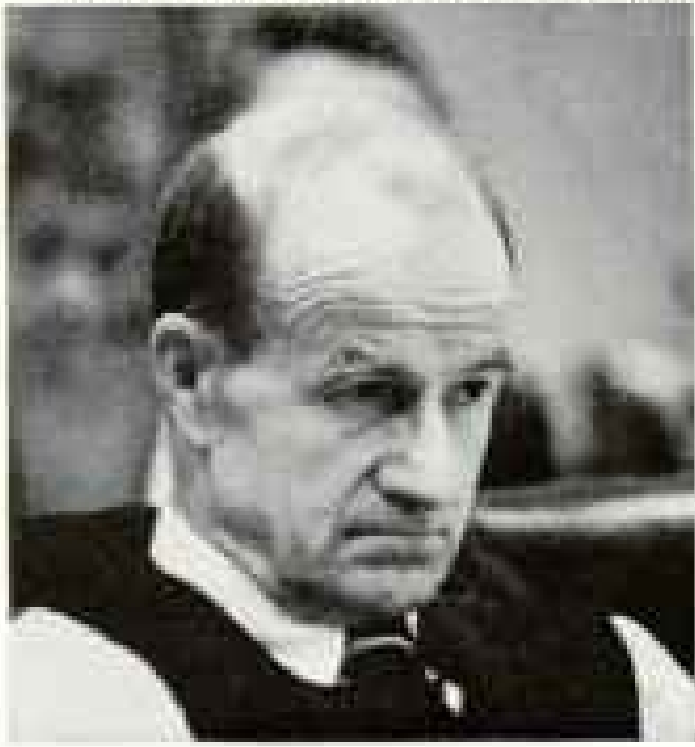
The discussion that emerged from around this table was as diverse and thought provoking as the panelists themselves. Following is a digest of their remarks.



the Future



PHOTOGRAPHS BY EMORY ARLETT



GERARD PIEL, publisher of *Scientific American*, studies the impact of urban life on society as a longtime *New Yorker*. His book, *The Acceleration of History*, discusses the effects of rapid technological change.

THE FIRST THING to be said about the future, in my opinion, is that the economic problem—the struggle for subsistence—will have been solved. We have already come to the solution of the economic problem in the industrial world, and most particularly in the United States, by the application of high technology to the creation of wealth. We have depended upon growth to heal the divisions and inequities in our national life.

In the past two generations we have reduced the proportion of our people living in poverty from two-thirds to one-tenth. But we have reduced poverty by growth alone, without a change in the distribution of incomes and of property, which remain today very much as they were at the beginning of this century.

A curious and ugly symmetry characterizes that distribution: 5 percent of the

people at the top of the pyramid consume 15 percent of the national income, while 20 percent at the bottom live on 5 percent of the income. As we look into the future, the economic problem is not a permanent problem of the human race.

Despite the imperfections of our society, however, we see in our vital statistics, and in those of every other industrial nation, the impact of industrial abundance. All the industrial nations are approaching zero population growth. First their death rates came down. Then, with surviving offspring assured, they reduced their birthrates. We have every reason to believe the same will happen in the developing countries, as they achieve economic expansion. The annual growth rate of the United States is now below one percent.

So we can look forward to a world of stable human



RICHARD F. BABCOCK, Chicago attorney and authority on planning and housing law, is often caught in the fray between environmentalists and advocates of low-cost housing. His book, *The Zoning Game*, describes the contests waged over private land.

WE MUST RECOGNIZE that for centuries ownership of land has conferred privileges that extend to the ownership of no other commodity. The homestead exemption, the unique rights of the landlord in relation to the tenant, and the relative freedom from governmental constraints on land sales compared to sales of securities are just small illustrations. These are attitudes based upon at least six or seven hundred years of law and social custom. So I suggest that changes in the structure of land ownership and in attitudes toward the rights of owners of land are going to move only with glacial slowness.

Some things will change. I believe that by the year 2000 the states will have a significant voice in land-use policy—and they should. The states will take back significant parts of the power they granted to municipalities half a century ago.

People realize that we can no longer deal with environment solely at the municipal boundary: Land use determines the environment; it has to be dealt with on a more comprehensive level. Also, there are more and more challenges in the courts to municipal land-use restrictions that tend to keep out people because of their inability to buy expensive housing.

I believe the scheme of

population. If that is the case, we must then think of zero economic growth as well. This is profoundly overturning to all our thinking processes. **We face the prospect that growth—the central driving principle of economics—will come to an end.**

This “steady state” economy I have predicted would not necessarily imply distresses. I think it might be a considerable improvement on our present condition, for the end of economic growth does not mean a stationary state of human improvement. Such an economy, rather, would be engaged in recycling materials and in cherishing renewable resources; the key to both will be the mastery of new sources of energy. The principal enterprise will be education, the perfection of the individual through education for all.

When the accumulation of wealth is no longer of high social importance, there will

be great changes in the code of morals. It will also be difficult to distinguish work from leisure, with human needs satisfied by some more equitable system of distribution. People will engage in work for their own satisfaction.

On the question of land use, I think it is perfectly clear that we’re going to see the end of suburbia. The suburban dwelling is the most wasteful of resources and of energy. All of the public investment in highways, sewers, and all the rest that makes this system possible is accomplished for the more fortunate at the expense of the less fortunate. Suburbia represents the “every-man-for-himself” morality.

We’re going to see the American people resettle in the city. City life will now become a communal task and a cooperative enterprise. In the countryside we can expect to see intensive multiple use

of the land—and a restoration of the values of rural and wilderness life. The productive land and the wilderness will be the “commons” of society.

It’s quite apparent we will be living in the post-petroleum age. If we make the response we have to make to it, we will need to invest at least 600 billion dollars in our energy plan between now and the end of the century. Now if that 600 billion dollars in investments cannot be the energizer of the economy and of the entire social apparatus to accomplish marvelous changes and improvements in the way Americans live, then we really are lost.

We stand around wringing our hands over this energy question. In point of fact, this is a godsend of an opportunity to get the private and public sectors together in conducting a major enterprise—the reconstruction of our country.

regulation by the year 2000 will be much like that set out in the American Law Institute’s Model Land Development Code, with the state making the final decisions on large-scale development, on sensitive geographic areas, and on development that has a regional impact.

If we are going to have a rational and equitable growth policy, we must get rid of this nonsense that every small community may define the public welfare in its own image, and decide through its zoning and subdivision regulations which economic classes it’s going to let in and which it’s going to keep out.

It is equally unreasonable

that in our large cities sub-communities of 50,000 to 100,000 people have practically no voice in land-use decisions that affect their neighborhoods.

We must figure out a way to “suburbanize” the inner-city neighborhoods—to give them more of a voice.

I believe another feature of the year 2000 will be that large-scale ownership of the land will be treated much as we treat public utilities today. Price, rate of return, and soundness of investment will all be subject to scrutiny. Why should the utilities be singled out while the market in real estate continues to operate by 19th-century rules?

I suggest that by 2076 dealing in land in the marketplace by government will be an accepted practice. Government will own land, not merely to control growth, but to control price and influence the market.

By the year 2076, unless we achieve a racially integrated society, you are going to see our big cities substantially all white.

In the next 20 years at the longest, the suburbs, where the jobs are already moving, will be open to blue-collar blacks. Whether that will “Johannesburgize” our cities—black suburbs surrounding a white core—is another question.



ISAAC ASIMOV, biochemist and humorist, has written 172 books, ranging from the engaging science fiction of *Fantastic Voyage* to *Asimov's Guide to Science*.



BUCKMINSTER FULLER, who invented the geodesic dome and the tetrahedral city, has inspired generations of students with brilliant lectures and such lucid books as *Operating Manual for Spaceship Earth*.

THE MOST DIFFICULT THING for me to grasp in the world today is the actual rapidity of change. It has become so explosive that none of the conclusions we arrive at may have any meaning whatsoever 25 years from now. I maintain that in a relatively short span of time, within the lifetime of middle-aged people today, the situation on earth will change to the point where any form of planning that is less than global in scope will be useless.

I agree that we will have to have a steady-state society, in which all innovations will be looked

I'VE BEEN AROUND the planet a great deal—I've been around it 39 times. And I really do see and feel it as a sphere. We are so tiny on our tiny little planet with our tiny little sun that I am sure the universe is not waiting around to see if a Republican or a Democrat is elected.

All of the old concepts of wealth related to the land. Without land, you couldn't eat. It *was* wealth. But technology, know-how, worked a radical change in the idea of land as wealth. It became centered on the possession of the metals, like copper and tin and iron, used by technology. Control of the seas over which these metals moved created empires, and land became of less and less importance as scrap metal recirculation progressively replaced new mining.

The problem confronting us today is the incredibly inefficient use being made of our technology. Of the vast quantities of energy being

at closely for possible evil side effects, because the big slogan of the 21st century will be: **No More 20th Centuries!** But still, the tendency toward growth is inescapable. If we can't grow in numbers, and if we can't grow in the sheer size of things, we are going to have to grow in new directions.

I have written about the world or global village, tied together electronically, with every citizen able to communicate instantly with every other. I think this has merit because even in the resurgent city discussed here, propinquity will not

consumed by humanity, the amount that results in actual benefit to human beings is very small indeed—perhaps as little as five percent.

We are using our machinery that can work 24 hours a day for only 8 hours. Considering the banking and mortgaging practices of the past years, we are half a trillion dollars in the hole for underwriting obsolescence. We keep putting up all these buildings to accommodate fake employment. These great buildings in our cities are just for making money. **We have typewriters sleeping with the good plumbing and we have people sleeping in the slums.**

In order to understand the future, we have to move to a "cosmic" accounting system. I asked a noted geologist to do a study on how much energy nature expended in the making of petroleum. We found it cost nature, over the eons, a million dollars to produce a gallon of petroleum,

necessarily mean intercommunication. I live on the 33d floor of a large apartment house in Manhattan. I don't even know who's on my floor.

It seems to me that there are two other directions we can take—we can go down, we can go up.

Down—that is, underground cities—has a lot to recommend it, especially in that it leaves the surface free for other life forms. We can't consider land use as for the benefit of mankind and mankind only.

In an underground society we no longer have weather.

We can live all year round in an equable temperature at all latitudes. We can have transportation not affected at all by inclement weather. We can establish our night and day the world over to suit ourselves and thus remove a great deal of what separates us from each other.

Going up, however, is perhaps the more attractive direction and the one that mankind is more likely to take. **Our concept of land use now may include not only the land on the surface of the earth. We can colonize the moon or build space colonies** (page 76).

at the rate at which you and I pay for electricity. This makes selling Manhattan Island for twenty-four dollars look like nothing. All those people driving in to work every day—they're each spending two or three million dollars a day, at least by nature's accounting.

For centuries we have lived in an East-West world, with national wealth depending upon control of the oceans over which moved the raw materials for industrial nations. But the wealth now is in energy and its production, and we must consider a North-South world bound together across the North Pole.

Right over the Pole from the Americas are the Soviet Union and China. The technology of ultrahigh-voltage electrical transmission makes it possible to connect Russia, China, and the Americas into a single gigantic power grid. This grid would connect night and day;

at one time or another, 50 percent of our electrical generating capacity is not working, but with night and day connected in an intercontinental grid, we suddenly discover that our generating capacity has been doubled. Nothing will bring world economics into common accounting more rapidly than that energy grid.

Humanity is still struggling along in a complete misapprehension, greatly fostered by ignorance and fear. In this great fear, human beings still assume that there is a fundamental inadequacy of life support on our planet. Every one of the great ideologies says, "You may not like our system, but we have the fairest, most logical and ingenious way of coping with the fundamental inadequacies. Because others think differently, we finally must have a showdown of guns."

For the past 20 years, we have had the nations of the earth getting ready for

In the moon we have a world that is really dead, which has no ecology. We can make use of it any way we want, without interfering with any life-force.

Colonies, whether they are on the moon or in near space, would fulfill functions that are now fulfilled by the cities on the surface of earth. Properly handled, the earth may become a rather parklike world, a rather low-density world, with most of humanity living in space communities. And then, someday, there will undoubtedly be a panel talking about the future of space use.

Armageddon, taking the highest capabilities of man and focusing them on waste. I know the political assumptions that say there is not enough to go around are invalid. I know now that politics is invalid. I know war is invalid. Yet, I also know the technology, and I know it is highly feasible to take care of all humanity at higher standards than anyone has known. Just consider that today one communications satellite weighing less than a ton can outperform the transatlantic communications system with its 175,000 tons of copper cable.

In times past, with 90 percent of humanity living on farms, the human race was inherently remote. Every nation looked out for its own welfare. But now we are in absolute critical proximity. A completely new world has come about. Our greatest challenge today is not at all how we get on independently but how we get on together.



EDMUND N. BACON, city planner, encouraged citizen participation when he helped spark the rebirth of Philadelphia, his hometown. His book, *Design of Cities*, travels from Athens to Brasilia.

IN THE FUTURE we have to perceive ourselves as urban people. The mere acceptance of the notion that we are an urban civilization will be an important revolution in thought, because we still cling to the nostalgic idea that we are primarily rural.

We are assisted considerably in facing up to the problems of urban settlement by the fact that the petroleum of the world is rapidly becoming exhausted. We are going to have to move from a petroleum-base mobility to an electric-base mobility. **We've got to quit using petroleum for our basic way of getting around.**

This has enormous consequences. The form of the cities will be different. The future extensions of our cities, the future housing, will occur in relatively intense areas clustered on electric-transportation lines. Since

these lines will converge toward the existing center of the city, it means that the center, which we think of at the moment as decaying and being abandoned, will have a resurgence and will again become the focal point of communication.

The great illusion of the suburban experience was that man can experience nature by owning pieces of it. And that is fundamentally incorrect. Nature eludes ownership.

Becoming more urban and less suburban will also reverse the rhythm of life, to our great benefit. Right now a suburbanite goes daily in and out, leaving his nature in the morning and coming home when the sun is setting and the children are going to bed.

A genuinely urban civilization would have not a daily but a weekly rhythm. We would spend the workweek, perhaps four days, in the highly social atmosphere of the city, at the end of which we would move outward to the mountains and the sea and the farm.

Low density of the suburbs is nothing but an insulation of human communication. Intensive development is necessary for the quality of the life of the children. They should not have to depend upon their mothers being chauffeurs in order to make contact with friends.

Let us visualize the re-utilized city. Blocks will be reorganized to represent separate living communities.

At the end of each block there will be electric buses and electric taxicabs. The only reason for a vehicle will be to bring a baby home from the hospital or to take a casket out. **By this concept we lead people into a view of the removal of petroleum as being not an obstacle, but a fine, creative thing.**

There is more than plenty of space in our cities. In Philadelphia there are 28,000 abandoned houses and 12,000 vacant lots. It ends up that 40,000 units are abandoned in the middle of the city, with all the sewers and water and everything else provided. Again there is a trend toward the concept of homesteading—not in the prairies, but in the wastelands of our inner cities.

We don't have to build new towns. The new technological town is a total dead end. Besides, there is a whole series of middle-size cities that have a new possibility for creating new life-styles, including a more sympathetic approach to nature and less consumptive ways of doing things. New perceptions of land are going to make for a situation where private property versus control doesn't become the main conflict.

The American people are quite capable of being way ahead of the scientists, technologists, and philosophers. Americans love their land, and they need to be shown how better to cherish it. □

Beer-can midden behind a Montana tavern marks a sad misuse of private land, one legacy of America's throwaway society.



The Next Frontier?

By ISAAC ASIMOV

Paintings by PIERRE MION

I DID NOT REALLY UNDERSTAND what L-5 was like, on this July day in A.D. 2026, until I no longer saw it from my vantage point in space.

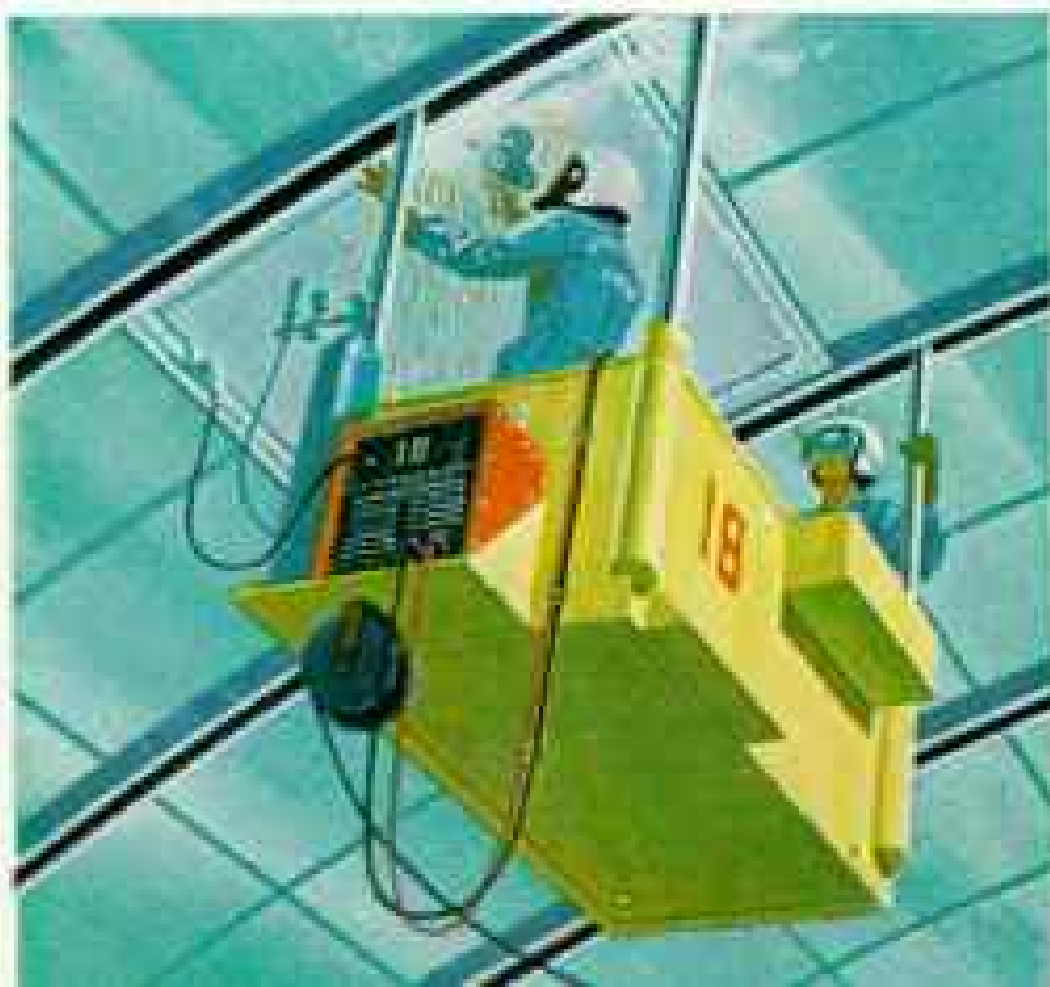
On the shuttle flight I had observed by telescope the torus that we all recognize, much like a bicycle wheel, gleaming in the direct light of the sun and in the light reflected from the large mirror floating free above. The six spokes and the central hub were visible too, of course.

The shuttle craft was built for durability, not comfort, and I welcomed the end of our journey—a three-day flight. As we moved in toward the docking module, L-5 stopped being a torus in space and became a habitat, a world with 10,000 people. The hub is a sphere 130 meters in diameter, which seemed huge when we were immediately above it. The six spokes led out to the torus proper, the nearer edge of which was 765 meters away. What it *(Continued on page 81)*

Shape of things to come? Even as Apollo and orbiting Skylab recede into history, American scientists consider a more awesome enterprise—a permanent colony in space. Here a cargo tug maneuvers to dock at L-5, where 10,000 people live under artificial gravity in an encircling tube called a torus. Their mission: to build more colonies as well as satellites for beaming solar energy to icy-blue earth.







“Supermarket” farming grows crops on shelves and raises livestock in the aisles of one of three agricultural sections. Beyond, a commercial and residential area curves with the arc of the circular tube, whose diameter is 130 meters—425 feet.

Conditions necessary for the ultimate greenhouse—controlled sunlight, freedom from pests and diseases, tightly recycled



wastes, and automated cultivation, pollination, and harvesting—are all fulfilled on the superproductive farms of the colony.

A monorail along the top serves for mass transit, with stations at each of the six supporting spokes, such as number 2 shown here. Within the spokes, elevators carry passengers to the torus's low-gravity hub.

At upper left and in an enlargement (left),

repairmen working in a yellow service pod on tracks mend the glass "sky" by replacing a faulty pane that has let some of the habitat's atmosphere escape. But there is no danger, and people along the catwalks look on with only mild curiosity. To them, the scene, the idea, the reality has become part of life's routine on colony L-5, named for its location in space (page 83).



(Continued from page 76) amounted to in older units of measurement was that L-5 was a little more than 1.1 miles across.

There were the usual complications of docking, establishing an airtight seal, and getting through an air lock. Then I underwent a brief medical examination. Finally George Fenton greeted me. The head of L-5 was a stocky man with a shock of brown hair and a swarthy complexion. He was dressed lightly and loosely, but not exotically. His personal attention, I gathered, was not unusual; a freelance writer for NATIONAL GEOGRAPHIC was treated with the same courtesy as any arriving visitor.

Hub's Low Gravity an Aid to Research

"The day will come, sir," Fenton said, "when there will be colonies large enough to take in the shuttles whole. It will be much easier when that day comes."

I protested that it had been no trouble and looked about. Somehow I had expected to get into the hub and see a cavernous vista. Instead, I found myself in a corridor very much like that in any large office building back on earth—except for the bars and handholds one requires at low gravity.

"There are no living quarters in the hub," Fenton said. "There's a small hospital here for cardiac cases and orthopedic problems. There are also research laboratories. Some of these are biological, studying the effect of low gravity on living systems; some are industrial and engineering. . . ."

"You mean it's here that you grow crystals and manufacture electronic components?"

Fenton smiled. "No, not here. Not enough room and, besides, we need a vacuum for that. Our manufacturing plants are out in near space, and are attached to the main body of L-5 by transport tubes.

"Of course we are not yet self-supporting. We depend on earth for much of our high technology as well as our culture, education, and medicine. However, we have already become an important part of earth's

computer industry and a source of many of the microminiature circuits it uses."

"To say nothing of your manufacturing solar-energy stations?"

Fenton shrugged. "That's an old story. The first solar power station was operative and sent into orbit around earth even before L-5 was entirely habitable [pages 88-9]."

"We will want to go out to the torus, and the third elevator bank is nearest. Do you mind starting there?"

He took my agreement for granted, for he seized the nearest handhold, pushed off, and went shooting along the corridor. I followed, but with far less expertise. There wasn't quite the sensation of shooting upward that one gets in the zero gravity of a coasting shuttle. The weak gravity was enough to make the flight seem horizontal but to have me sinking slowly. I caught another handhold and brought myself to a yanking halt. I walked the last few meters, rubbing my shoulder.

"I'm sorry," said Fenton. "I know you've had space experience, and I rather thought you were used to this."

"I am," I said. "Just not quite enough."

Elevator Picks Up Speed—Sideways

The elevator door opened, and I stepped into a semicircular chamber about five meters deep and rather more than that across.

Fenton said, "This elevator car fills about one-third of the spoke, and there's room for another one."

Fenton hooked an arm around one of the six vertical bars spaced through the car, and I took another, assuming there was some purpose for that.

I said, after a time, "Aren't we moving rather slowly?"

"Yes, we are. Two reasons. First, the gravity effect gets stronger as we move down, and the body adjusts more easily if the change isn't too rapid. After all, we go from nearly nothing to full gravity in a matter of just about a kilometer. Second, there is the Coriolis force that results when you move

Main Street, Hometown, Cosmos finds colonists on the move, passing the stacked, modular habitations and shops of L-5. Fountains and fruit trees relieve the stark simplicity of a manufactured environment. The alumni of earth can order buildings, climate, and sunlight to suit. Yet L-5 is no playground in the void. Hardworking pioneers make it the latest outpost on a limitless frontier.

from a region of one sideways speed to another that is much faster or much slower. You know about it?"

I nodded, a little abashed. "I know about it, but I tend to forget."

One talks about gravity on L-5, but it's a centrifugal effect and that's not quite the same thing. The torus makes one revolution per minute. This means that the edge of the hub, which we had just left, sweeps out a circle of about 400 meters in that minute. The outer edge of the torus, making a much larger circle, moves 5,600 meters in that same minute, creating greater centrifugal force—a workable substitute for gravity. The elevator car moving downward is accelerated sideways—the Coriolis force—and I felt myself being pulled backward against the curved wall by my own inertia. I held on to the vertical bar and wished we were moving more slowly still.

Earthlike Vista Stuns a Newcomer

When the elevator came to a halt, I had regained full gravitational effect for the first time since I had left earth. That meant not only the three days spent in actual spaceflight, barring brief acceleration periods, but the two-day period of medical examination and quarantine while in low earth orbit. It was with only a faint nausea, however, that I stepped out, just a little unsteadily, into the sunlight streaming through the long line of windows above.

I stopped and stared. It was not just that the gravity was like that of earth. It was everything else as well. I had stepped into a compact American community with glass and aluminum buildings on every side (page 80).

My thoughts were easy to read, for Fenton said, "There are differences. No automobiles."

"Not many pedestrians, either, I see." The few that passed, all lightly clothed, greeted Fenton, and he lifted his arm, smiling. The greetings seemed to include me.

"Most of us know each other," said Fenton.

FAR FROM BEING "SCIENCE FICTION," this article visualizes the outcome of a serious proposal worked out last year by a group of 30 engineers and social and physical scientists. It will be described in detail in the NASA publication, "Space Colonization: A Design Study," to be published next month. Address inquiries to Prof. Charles H. Holbrow, Colgate University, Hamilton, N.Y. 13346, or Dr. Richard Johnson, Ames Research Center, Moffett Field, Cal. 94305.—THE EDITOR

"L-5 is a world, but it's also a town of 10,000.

"The torus is divided into six separate sectors, alternating between residential and agricultural. More than half the population lives in this particular sector, so you might say this is our city.

"The next residential area in the direction of rotation has most of our cultural units— theater, movie house, sports areas. The third has our schools and our library.

"Sunlight is filtered and dispersed by a series of mirrors overhead. Without earthly atmosphere, we have to be particularly careful of radiation. We can produce an eight-hour night every 24 hours by tilting the mirrors. It's part of making L-5 as earthlike as possible. The streets, you may see, curve a bit."

"Why is that?"

"So that you don't see to the end of any of them. If they were straight, they would end too soon, and you would have a claustrophobic feeling."

I was watching the pedestrians. Most were men in early maturity. I said, "Do the women and children stay indoors?"

Fenton said, "No, there just aren't many. We are still a pioneer community, you know, and our population is as yet unbalanced. Fewer than half of our more or less permanent residents are women. Nevertheless, there are families. We have nearly a thousand youngsters on L-5, some colony-born. My own daughter was born here five years ago."

Goat-milk Shake and Hare of the Dog

"What do the single people do?" I asked.

"Some stay single. Some go back to earth to try to find a mate. Some stay on earth, and some bring a spouse to L-5. Of course, there are no jobs on L-5 that can't be done equally well by either sex. Nevertheless, there are still old cultural habits that die hard, and we receive more male applicants than female. But as time goes by, we expect to have a normally distributed population.

"Come, let me take you to one of the sun-decks on top of this building."

The whole atmosphere changed when we went inside. Now there was the bustle of people coming and going in the corridors. Fenton led me past what was obviously a schoolroom. There were children on L-5. I even saw an infant occasionally, in a thoroughly earthlike baby carriage.

There were shops on the building's lower floors, small ones, but of considerable variety.

"Do you have department stores?"

"No," he said. "We find that anything too large tends to dwarf the torus. Psychologically, it is better to work with many small units. Would you like something to eat?"

I wasn't very hungry, but it seemed polite to have a frankfurter and milk shake. They were dispensed by token-operated machines.

"Did you like it?" asked Fenton.

"Oh, yes," I said cautiously. (Good enough, but I was used to better on earth.)

"That frankfurter is what we call 'Hare of the Dog.' H-A-R-E. It's made from rabbit meat. We are just establishing beef cattle on L-5 and haven't slaughtered any yet."

"And what about the milk shake?"

"Goat's milk."

We went up in a crowded elevator. Most of those on it got off at intermediate floors. Two men and a woman, scantily covered, stayed to the end. The area we entered was an unshaded terrace where about a dozen men and women were sunning themselves.

I followed Fenton to a railed edge and looked out over the rooftops.

"We're about 65 meters up," he said, "and gravitational pull is only 90 percent that at the surface. That's not enough to be aware of. But there. . .," he pointed outward, "is where you can see that you are not on earth."

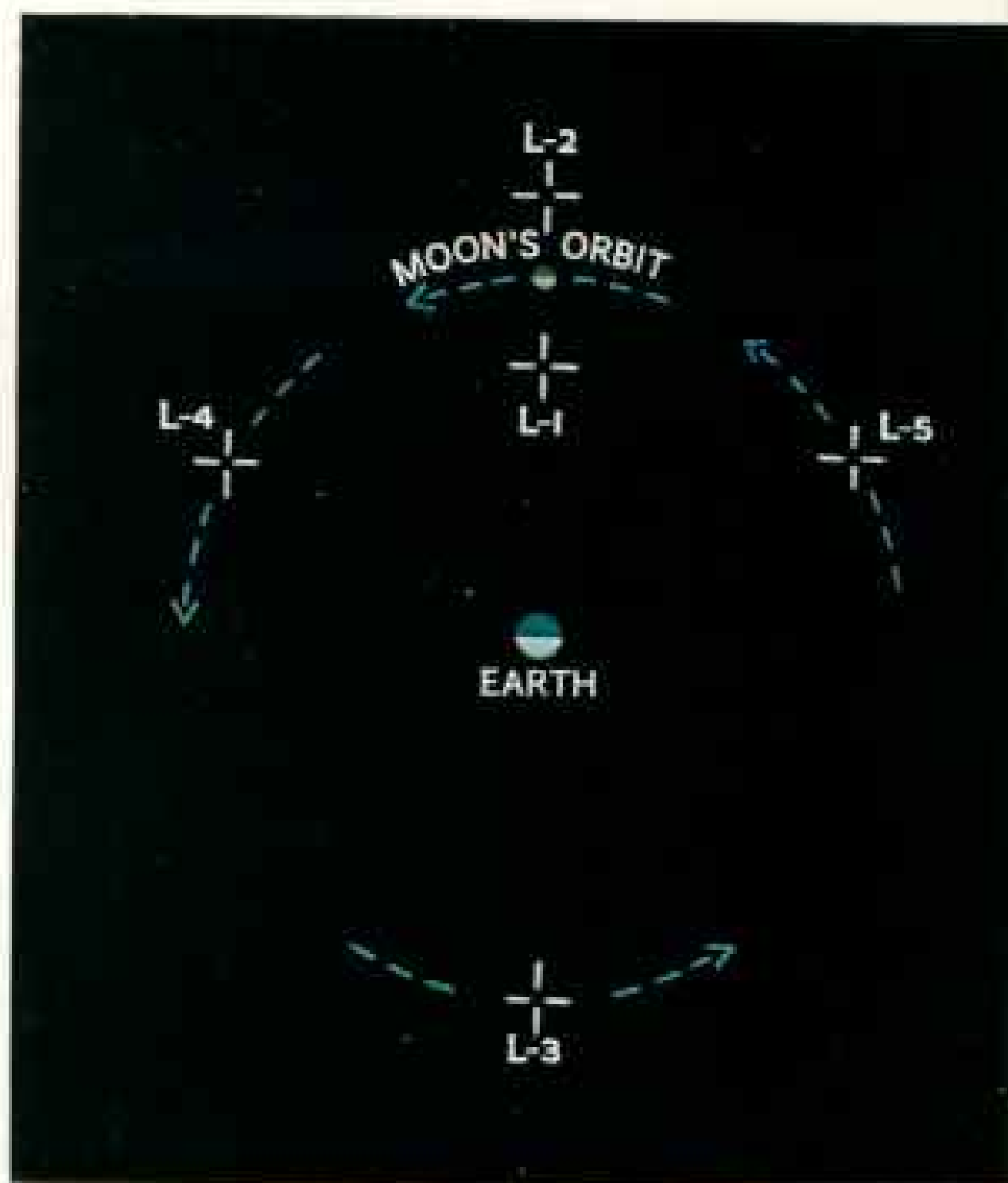
He was right. At that height I could see the curve of the torus from within. There was no horizon in the earthly sense. The line of buildings stretching out below me seemed to—no, *did*—curve upward. They came to an end and were replaced by greenery (the neighboring agricultural section) that continued the upward curve into a blur.

"Earth is different," I said.

"I know," said Fenton, reflectively. "I was born in Memphis; came to L-5 when I was 35."

"Do you miss earth?"

"Sometimes, but not very often. We try to keep the colony like earth, you see, but actually it's all moon dust. Almost everything you see was once on the moon. We've got L-5 people there right now, several hundred of them, mining moon material and sending it to the foundries in the neighborhood of L-5 [following pages]. We get endless quantities of aluminum, titanium, glass, iron, and oxygen from the lunar crust.



On a celestial ball field, earth is home plate, the moon second base, and point L-5 first base. Of the five points, numbered above, where gravity and centrifugal forces of earth and moon balance each other, the chosen site for the permanent space installation is at L-5. From low earth orbit, mining gear and personnel are sent to the moon, while a factory and key workers are rocketed to L-5.

Then in a "double play," raw materials are fired from the moon, caught at the stable point known as L-2, and then hauled to the factory for building the space colony. It, in turn, builds solar-power satellites that are towed into geosynchronous orbit above the earth (page 89).

"Then, too, the soil in which we grow our plant life is moon soil, a little modified. In fact, the only raw materials of importance that we must still get from earth are light elements: hydrogen, nitrogen, and carbon. The imported hydrogen combines with our own oxygen to give us our water supplies. Actually, we import only small quantities since we cycle very tightly. But come, I don't want you up here too long."

He said, when we were back in the comparative emptiness of the streets: "The

shielding helps keep out cosmic rays, but perhaps not quite efficiently enough. There's some controversy there. We have enough lunar slag built up outside the walls of the torus to give us safety, but the hub and spokes are less well protected."

We were walking leisurely, and he said: "L-5 is a transitional world only. It probably has a lifetime of no more than fifty years. At this very moment we of L-5 are engaged in building a second colony, which will be larger and more elaborate than the first. Before it is ready, we will have begun a third. We expect many colonies to be built—in fact, aside from solar-energy stations, colony building will be the chief task of colonials for a long time to come.

"Larger colonies will afford even better protection against cosmic rays, give us a lower rate of gravitational change as we move up and down, a better horizon effect, more natural atmospheric phenomena—perhaps clouds and rainfall. Eventually, we will even have artificial hills and mountains."

Colonies Won't Ease Overcrowding

I said, "Could there ever be more colonists than earthmen?"

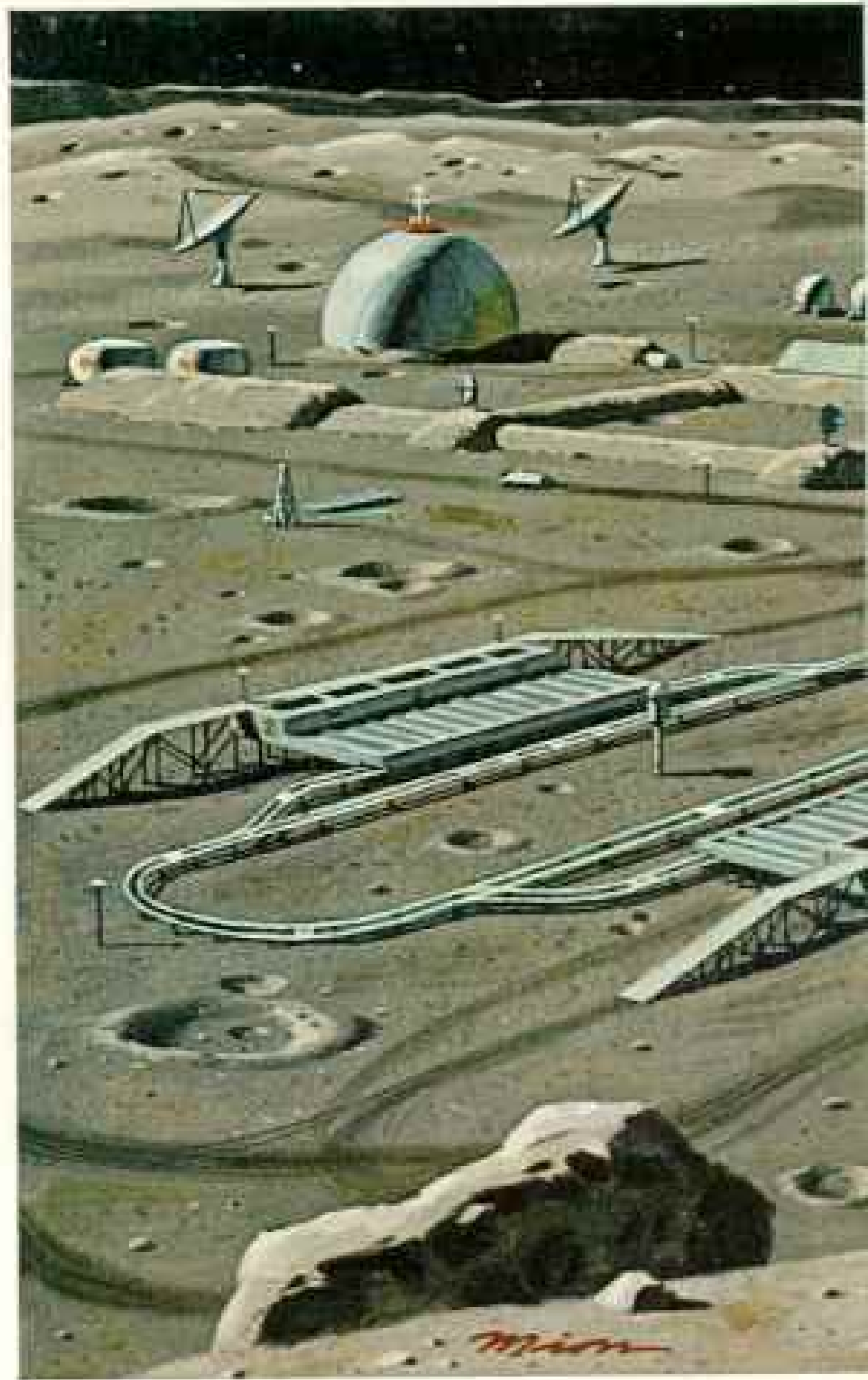
"That prospect is far in the future, if ever. For centuries at least, the number of colonists will be only a tiny fraction of earth's population, so that the mother planet will have to continue efforts to control population. . . . Be careful now, we're passing through one of the air locks."

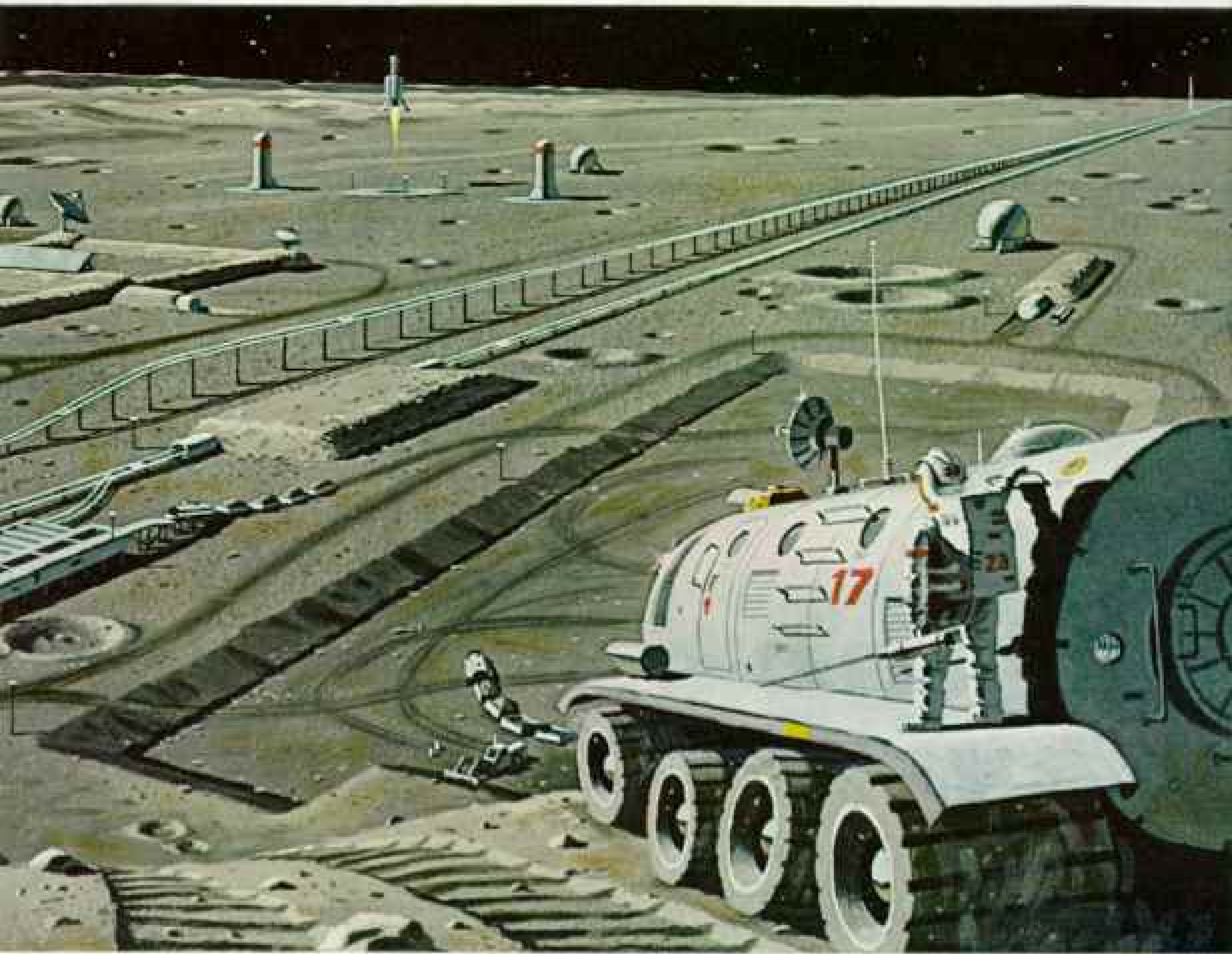
"Where?" I said involuntarily, as I walked up a flight of stairs and over a low barrier.

"The titanium seal is not drawn across right now," Fenton said. "Each of the six sectors is cut off from its neighbors by an airtight seal. It reduces the problem in case of puncture by meteoroids or accidents within. Any vibration of the torus wall, any small drop in atmospheric pressure will sound an alarm and then automatically close all the locks. Of course, the locks close during the eight-hour night period to prevent light leaks from the agricultural sectors, some of which are under perpetual sunlight."

"Has it ever happened? Accidents, I mean?"

"No. The probability is small, actually. Meteoroids large enough to penetrate the radiation shield are quite rare, and we offer a very small (Continued on page 89)





It seems like sheer fantasy, mining the moon to build colonies and satellites in space. But scientists now see the project as practical and profit making.

Mining is itself sandbox-simple. A front-end loader scoops lunar soil from a rectangular pit (above) and loads it onto gondola trains. The trains leave the pit, then climb up a ramp to dump the soil into a compression station. This is linked to what resemble pipelines on a trellis.

Enter a new concept. Lunar soil is pressed into ten-kilogram pellets. These are fed into metal buckets within the pipeline. Nuclear power generates electricity

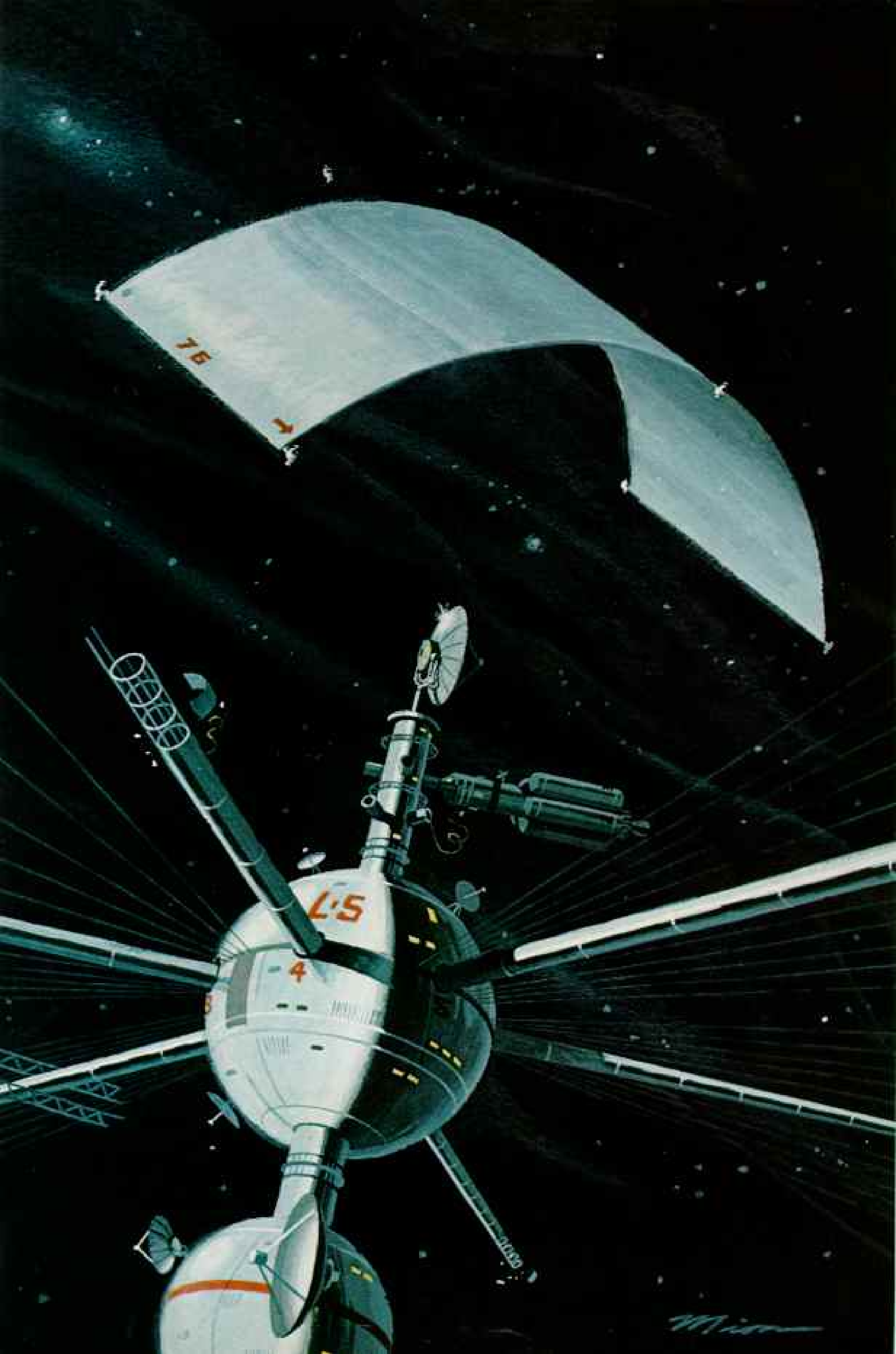
to surround the pellet-bearing buckets with a magnetic field. Accelerated for ten kilometers to 2,400 meters a second—the speed needed for an object to escape moon's gravity—the buckets jettison the pellets, which continue on into space. Some 80,000 kilometers away, at point L-2, a mass catcher traps the pellets—up to a million metric tons a year—which are thereafter transported to L-5.

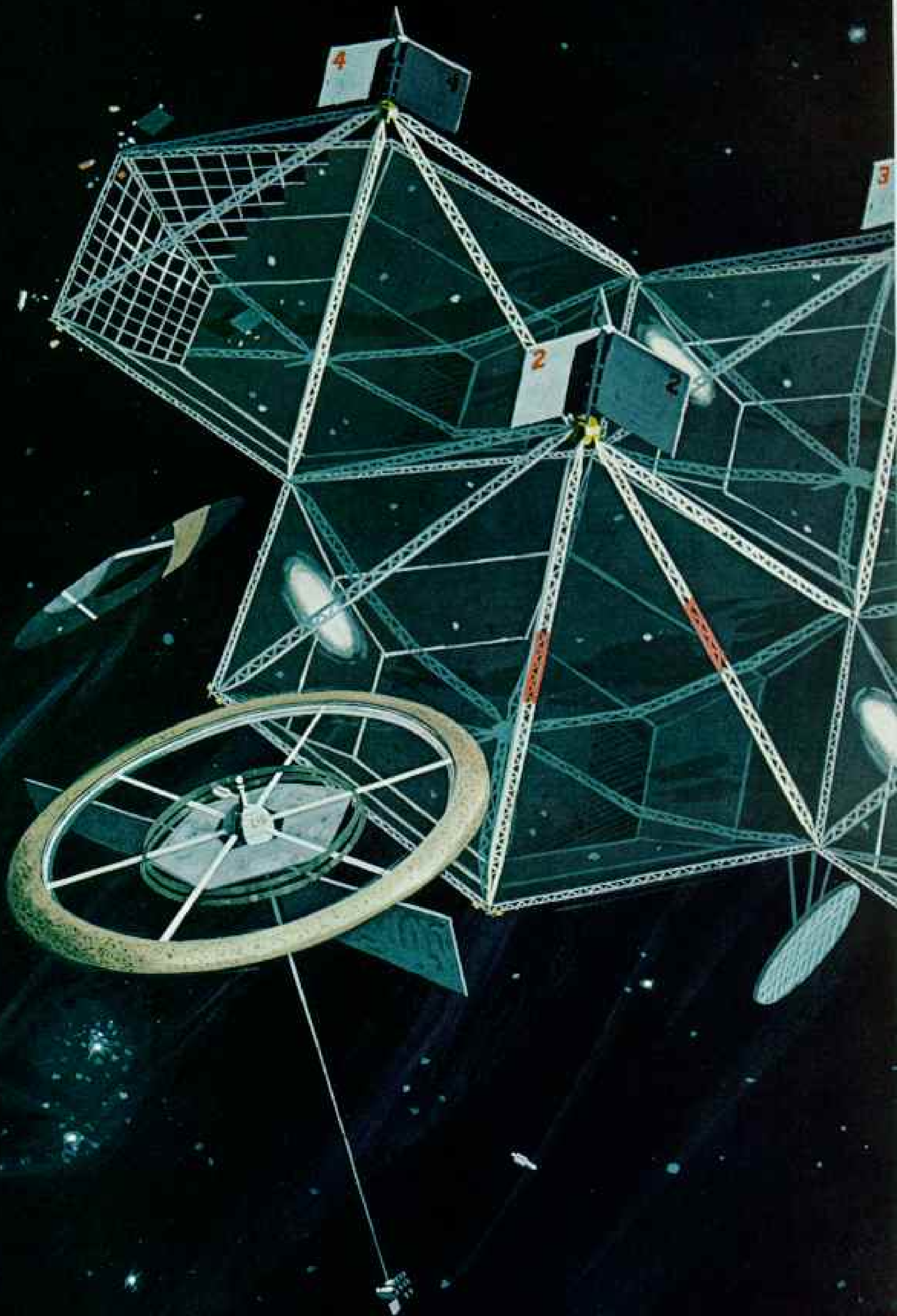
Tethered to L-5 by a ten-kilometer transport tube, a factory (left), with furnaces fired by a bank of parabolic solar mirrors, refines moon pellets into glass and aluminum, the latter emerging in a huge sheet.

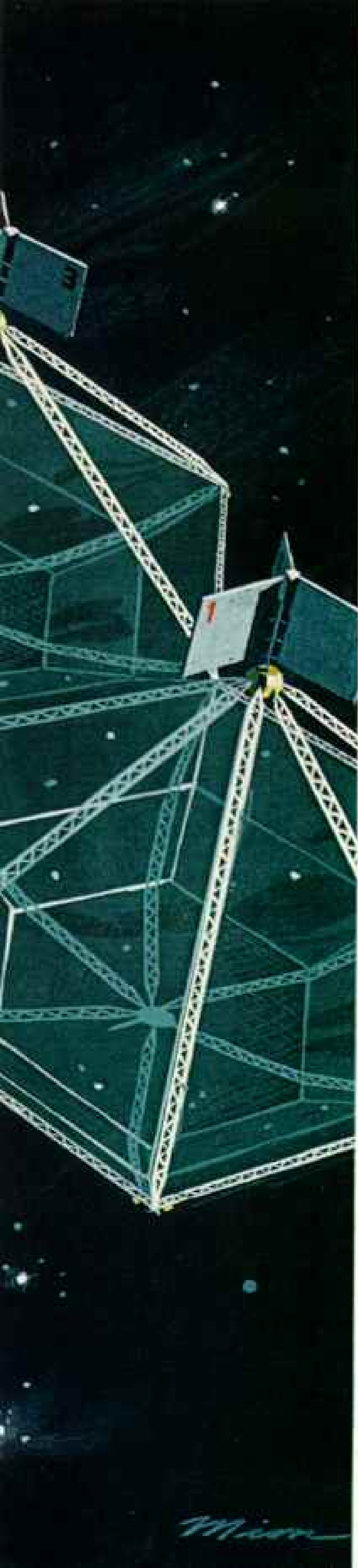
Nothing is wasted. By-product oxygen becomes part of the colony's atmosphere. Slag becomes shielding to block dangerous cosmic rays. The colony under construction appears small in the distance.

Building the habitat (following pages), piloted ANTS (Assembly Non-Tethered Ships) guide manufactured sections into place for attachment. Movable bulkheads on a section of tube (one numbered 3, upper left) confine an atmosphere for workers within. Mottled panels of slag for shielding fit together like paving blocks.









(Continued from page 84) target. Even if we were punctured, air loss would be slow because of the large volume. Air pressure is only half that on earth though there's just as much oxygen," continued Fenton, "but we've cut down the nitrogen to slightly under half the earthly level. Visitors aren't even aware of the difference, except to say that the air is clearer than on earth."

Vision of a New Land of Plenty

I was walking on a catwalk, and on either side were closely planted tiers (pages 78-9).

"This one is our diversified sector," said Fenton. "Here we have vegetables, chickens, goats, as well as rabbit hutches and fish pools. We depend on recycled water, and this sector contains one of our chief cycling stations."

He pointed to a windowless metal structure.

"You mean—wastes?"

"Yes, of course. We retrieve water from organic wastes. What's left is fertilizer. Would you care to go inside?"

I shook my head, "Perhaps not."

Fenton nodded. "Visitors rarely seem to want to. You understand, don't you, that recycling proceeds on earth too? There it is a larger circle—less noticeable, but more dangerous. We exclude the pathogenic bacteria from L-5, as you must know from your own physical examination before you came. Frankly, there is far less odor in the cycling station than in the area with the chickens and goats."

"Even so," I said, smiling.

"All right. We'll keep on walking. There are plenty of other things to see. The other agricultural sectors have our grainfields: wheat, rice, corn. Under uniform and controlled sunlight, with unfailing water and fertilizer, equable temperature, and a slightly higher carbon dioxide content in the air, the yields are many times what they are on earth."

For the moment, I wasn't listening. We were skirting a long fish pool, and there were small machines moving busily among rows of vegetables. L-5 might be just a pinwheel in space when viewed from outside, but it was a world once one was inside.

It was the first of many others that would be larger—and better—and that might someday in the far future (who knows?) bear within their graceful bodies the major portion of mankind's numbers. □

Son of L-5, an enormous power station ten kilometers across nears completion behind the spinning torus. The station will be towed into geosynchronous orbit, where it will remain above one point on earth's surface. Its mirrors will concentrate solar heat to drive turbogenerators and produce electricity. Converted to microwaves, the energy will be beamed to earth and reconverted to electricity. Eventually, space colonies and power satellites may be as plentiful as milkweed seeds in the wind, and earth's energy crisis a forgotten episode.

THE MAN BEHIND THE MYTHS

Geo. Washington

BY HOWARD LAFAY
NATIONAL GEOGRAPHIC STAFF

PHOTOGRAPHS by TED SPIEGEL
BLACK STAR

RARELY HAS HISTORY so obscured a hero. The adulation of his contemporaries—"Had he lived in the days of idolatry, he had been worshipped as a god"—drowned his achievements in saccharin. Generations of schoolchildren have nodded over fictitious accounts of his relentlessly righteous life. For too many, the name George Washington evokes the image of a stony-faced old man, an untroubled Olympian prig.

All of it false. Washington, all too human, knew ambition and greed and disappointment . . . grief and frustration . . . the pangs of unrequited love. In each of his triumphs pain preceded glory. The soldier who won independence for his country capped his first campaign with an ignominious surrender. The future President of the United States was soundly defeated in 1755, when he first sought elective office in Virginia. Washington doted on children. Yet—to his profound sadness—he who won the title Father of his Country sired no progeny of his own.

He hungered for love and, as a young man, offered his heart to a neighboring lady of high degree, Sally Fairfax. No evidence exists, however, that she reciprocated. He hungered also for property, but was bluntly rejected by at least one of the landed ladies of Virginia he

courted before he met and wooed the wealthy widow Martha Dandridge Custis.

When he finally married Martha in 1759, he became a faithful and affectionate husband; but not long before his wedding, he wrote what can only be termed a "love letter" to Sally Fairfax. And after the turbulence of the Revolution and the Presidency, he sent a bittersweet note to that same lady—who, with her husband, had removed to Britain in 1773—telling her that not all his honors "have been able to eradicate from my mind . . . those happy moments, the happiest in my life, which I have enjoyed in your company."

Like all Americans, George Washington came of immigrant stock. His great-grandfather John Washington stepped ashore in Virginia in 1657. Land was plentiful, and John Washington soon acquired both wealth and influence. By the time he died, he presided over an estate of 10,000 acres.

His great-grandson George was born in 1732. In an age of primogeniture, the baby's future loomed unpromisingly; he was a third son, born of a second wife. Of his early years we know only that his schooling was spotty—so much so that he ranks among the least educated of all United States Presidents.

Trained as a surveyor, the youth at age 16 journeyed to the Shenandoah Valley, on

All but deified by his admirers, our first President was in fact a many-faceted human, bedeviled like all men by pride, doubt, and ambition. But by the eve of the Revolution he had earned the reputation as "no harum Starum ranting Swearing fellow but Sober, steady, and Calm." For these traits, fellow citizens selected him to lead their fight for independence and, later, to lead the new nation itself.

1772 PORTRAIT BY CHARLES WILLIAM PEARL, COURTESY WASHINGTON AND LEE UNIVERSITY



the frontier of British America. He described his first lodgings there: "I... striped myself very orderly and went in to ye Bed... nothing but a Little Straw-Matted together without Sheets or any thing else but only one thread Bear blanket with double its Weight of Vermin such as Lice Fleas &c..."

Most of Washington's surveying took him to the Blue Ridge Mountains area. In that land of rich soil and clear streams, he came to understand the potential of the West as clearly as any American of his time.

From childhood, George had extravagantly admired his older half brother, Lawrence. Proprietor of the estate of Mount Vernon,

veteran of a military campaign, and an adjutant general of Virginia, Lawrence fired the boy's interest in soldiering. Lawrence's death from tuberculosis in 1752 desolated the younger man. Pervaded by his half brother's influence, George sought and obtained a commission in the Virginia militia. The following year, at age 22, he leased Mount Vernon from Lawrence's widow.

IN 1754, GOVERNOR Robert Dinwiddie dispatched Washington—by then a lieutenant colonel—with the 160-man Virginia Regiment into the Ohio Valley, which was being hotly disputed by France and Britain.



Washington's inexperience doomed the campaign. Although no state of war existed, he and his troops attacked an encampment of 31 Frenchmen, killing 10—including their leader, the *Sieur de Jumonville*. French propagandists were quick to exploit the fact that Washington had attacked a diplomatic mission, an act that helped spark the French and Indian War.

The young officer then had erected an ill-conceived stockade that was called Fort Necessity. The French duly attacked, wiped out a fourth of the command, and imposed a surrender in which the young American, who very likely did not understand the French

text, admitted the "assassination" of *Jumonville*. The document was, observed an outraged Englishman, "the most infamous a *British* subject ever put his Hand to."

In the wake of the debacle, Washington—"too ready to complain, too nakedly concerned with promotion," in the words of one biographer—resigned his commission.

The spring of 1755 saw Maj. Gen. Edward Braddock arrive in Alexandria with two regiments of British regulars. His mission: to drive the French from the upper Ohio Valley. Braddock soon learned that the former provincial officer had a useful knowledge of the Ohio country.

Braddock could offer Washington no rank that the Virginian regarded as worthy, but he decided to serve as a volunteer aide. Braddock, however, made no attempt to conceal his loathing for provincials: "... very indifferent Men, this Country affording no better..." Such chronic contempt for Americans by British commanders would pay bitter dividends at Breed's Hill, Saratoga, and Yorktown.

As spring mellowed into summer, Braddock's force advanced into the wilderness. On July 9 some 850 French and Indians ambushed the 1,500-man army. The regulars had never before encountered unseen foes who fired devastatingly from behind trees. They responded with a "*general Pannick*."

Braddock fell, as did many of his officers. Washington, in his report to Governor Dinwiddie, praised the valor of the Virginia companies. The British troops, he added, "broke and run as Sheep before the Hounds."

After three more years on the frontier—this time as "Commander in Chief of all Virginia forces"—Washington retired to the life he loved, that of a planter. Spending long days in the saddle, he expanded Mount

City that was his second home, Alexandria, Virginia, parades in honor of Washington's birthday. Here he recruited soldiers for the British hostilities against the French in the 1750's. With them he experienced defeat, then victory in the Ohio Valley. The First Virginia Regiment, wearing the casual hunting-shirt uniforms that Washington favored, recalls units he served with and lauded: "[They] behav'd like Men and died like Soldiers."

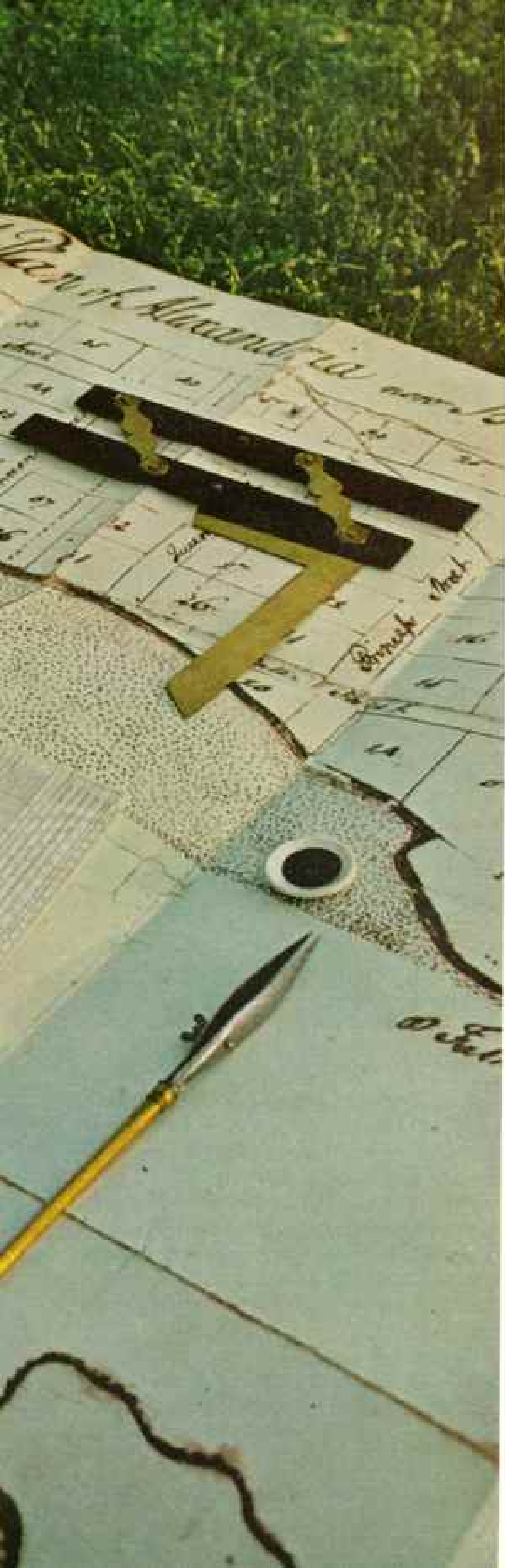




Potomack River

Maryland

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50



Vernon. Some sixteen years passed in such serenity. Meanwhile, in 1761 the death of Lawrence's widow brought George ownership of the plantation. Eventually his family, slaves, and employees numbered more than three hundred. He was founding a dynasty.

But was he? Martha had borne four children to her first husband. As the years at Mount Vernon drifted by, she failed to conceive. The sad certainty grew in Washington that he would leave no descendants.

When he was 54, he wrote a poignant letter to his nephew George Augustine Washington: "It is natural for young married persons . . . to look forward to a permanent establishment. . . It is also natural for those who have passed the meridian of life, and are descending into the shades of darkness, to make arrangements for the disposal of the property of which they are possessed. . . if Mrs. Washington should survive me there is a moral certainty of my dying without issue. . ."

Washington's apparent sterility, modern physicians speculate, might have stemmed from the malaria that wracked most Virginians, or from a chromosomal defect.

IN 1760 WASHINGTON'S FRIEND George Mercer described the master of Mount Vernon, then 28 years old:

" . . . straight as an Indian, measuring 6 feet 2 inches in his stockings, and weighing 175 lbs. . . His frame is padded with well developed muscles, indicating great strength. His bones and joints are large as are his hands and feet. . . blue-grey penetrating eyes. . . He has a clear tho rather colorless pale skin which burns with the sun. A pleasing . . . commanding countenance, dark brown hair which he wears in a cue. His mouth is large and generally firmly closed, but which from time to time discloses some defective teeth."

In fact, Washington's teeth plagued him into old age. His diary records the repeated

Tools of a man who loved land traveled with Washington from Alexandria—which he helped lay out in 1749—to land grants that he surveyed for neighbors. With money so earned, he purchased cheap wilderness acres, "the foundation of a Noble Estate." By 1775 the wealthy landowner was highly regarded as a plantation manager and politician in the Virginia House of Burgesses.

Bound for liberty: Winding through New Jersey woods, the First Troop Philadelphia City Cavalry reenacts a momentous ride of June 1775, when their predecessors escorted Washington en route to battle-torn Massachusetts. Only days before, the Continental Congress had unanimously elected the Virginian "General and Commander in chief of the army of the United Colonies and of all the forces raised . . . for the defence of American Liberty."

plaint, "indisposed with an aching tooth, and swelled and inflamed gum."

A modern dental historian, Dr. Bernhard Weinberger, has concluded that toothache, usually followed by extraction, became virtually an annual occurrence. When one contemplates Washington's brilliant role in the Revolution, one does well to remember the dictum of the scholar John C. Fitzpatrick that "toothache was gnawing Washington's nerves through it all."

During his period as a placid planter, Washington was elected to the Virginia House of Burgesses. In his 16 years as a burgess, he introduced few bills: one forbade hogs from roaming through Winchester. Nonetheless, so vast was the respect he inspired that—when the abuses and misunderstandings that led to the Revolutionary War neared their bloody climax—Washington was elected a Virginia delegate to the First Continental Congress of 1774. Among the also-rans: Thomas Jefferson.

AS EARLY AS 1769 Washington had begun to entertain rebellious thoughts. To George Mason he wrote: "At a time when our lordly Masters in Great Britain will be satisfied with nothing less than the deprecation of American freedom, it seems highly necessary that some thing shou'd be done to . . . maintain the liberty which we have derived from our Ancestors . . ."

The Second Continental Congress debated in 1775 exactly what should be done. The men of New England had already faced the British troops and, at Lexington and Fort Ticonderoga, had prevailed. Now an Old Testament host—warriors bearing names like Joshua and Aaron and Micah, Jeremiah and Nathan and Moses—had gathered on the heights overlooking the British at Boston.



On June 14 John Adams of Massachusetts addressed the Continental Congress in Philadelphia. He proposed a grand American army, owing allegiance to no individual colony but dedicated to protecting all. To command it, he nominated "a Gentleman whose Skill and Experience as an Officer, whose independent fortune, great Talents and excellent universal Character, would command the Approbation of all America, and unite the cordial Exertions of all the Colonies. . . ."

George Washington.

The Congress elected him unanimously.

Then rose Washington in full maturity, the foolish vanities of youth long behind him:



"Tho' I am truly sensible of the high Honour done me in this Appointment, yet I feel great distress from a consciousness that my abilities and Military experience may not be equal to the extensive and important Trust. . . ."

Among his immediate subordinates were two former British officers, Maj. Gen. Charles Lee and Brig. Gen. Horatio Gates. Neither wasted much respect on the commander in chief, regarding him as indecisive and amateurish. Their greater experience, though, deeply impressed Washington, who treated the two with far more deference than they deserved. Both ended their careers in disgrace. Court-martialed for insubordination,

Lee—who it was later learned had also provided the British with a plan for defeating the Americans—lost his commission. Gates fled in terror from a Carolina battlefield.

Washington rode toward Boston to assume command of his nascent army. Reaching New York City, he learned that the die had been cast. The British, deciding to smash the Boston siege, had attacked the Americans atop Breed's Hill. All through a sweltering afternoon the farmers and shopkeepers had awaited the assault of Gen. William Howe's superb regiments. Yet, crouched behind their crude fortifications, they had known no despair. An old man prayed: "I thank thee, O Lord, for

Last survivors of Washington's army



ONLY BOYS when they shouldered arms, these aging pensioners straightened with pride at the memory during photographic sessions in 1864.

Daniel Waldo, 101 (left), recalled being drafted as a 16-year-old into the Connecticut militia. Employed in scouting parties, he was taken prisoner by "refugees or cow boys"—as many Loyalists were called—and later exchanged.

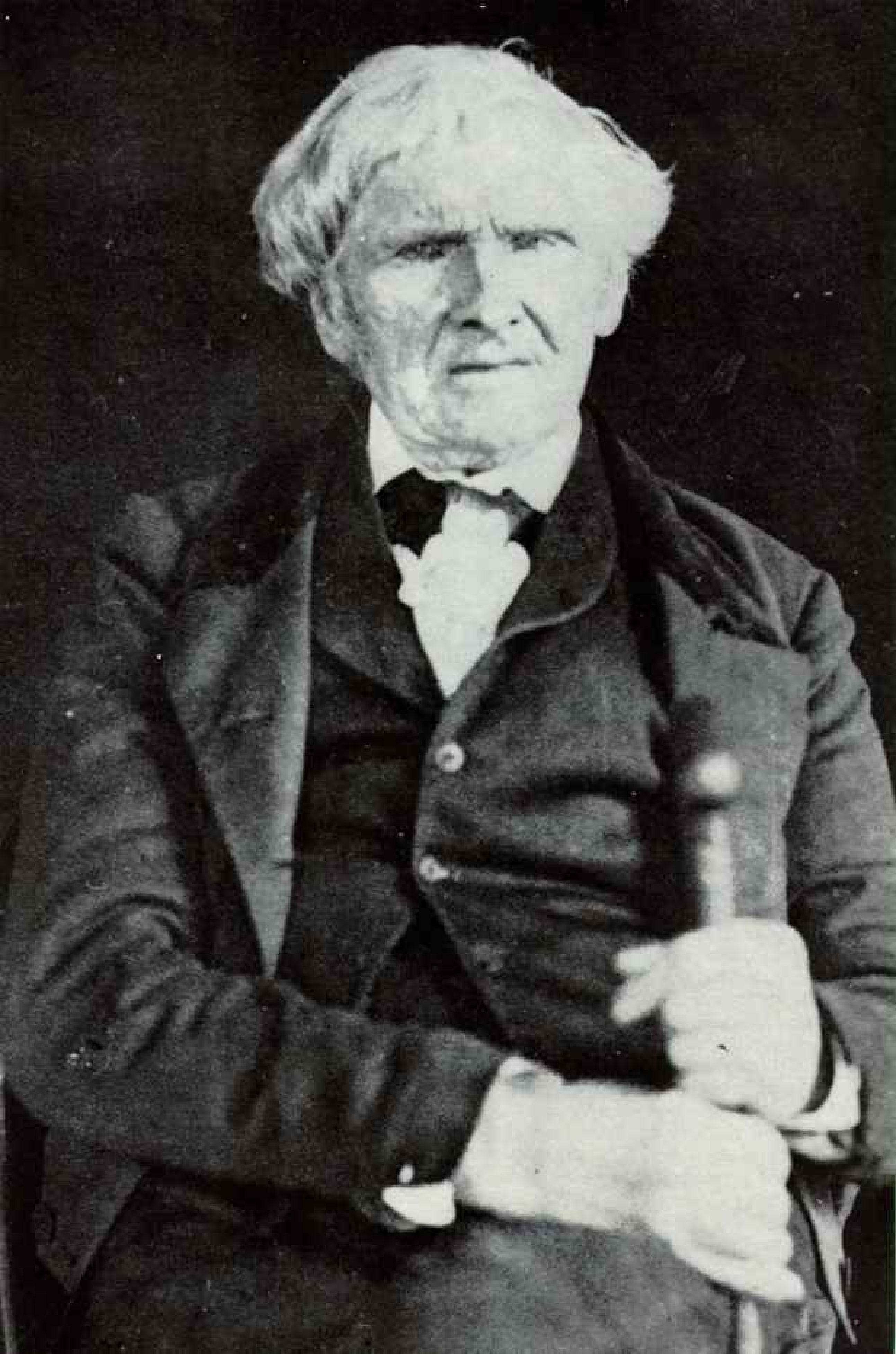
Adam Link, here 103 (lower left), saw duty with the Pennsylvania militia. Indians scalped his father during the war.

When captured at Castine, Maine, said William Hutchings (below, photographed at 101), he so shamed the British with his youth—15—that they released him.

As a child of 9, Alexander Milliner, 94 (right), was enlisted as a drummer in a New York regiment and was at Yorktown when the British surrendered. Milliner told of being Washington's drummer boy in the Life Guard, a tale that Pension Office records fail to corroborate.



ALL FROM MCGEHEE COLLECTION





sparing me to fight this day. Blessed be the name of the Lord."

Miraculously, when the regulars surged up the slope, the American volunteers did not break. Rather, they waited until the last excruciating moment before directing a withering fire into the British ranks.

Again and again and again.

The smoke cleared, revealing that the Americans had lost the hill and little more. The British, with 1,054 casualties out of 2,300 attackers, had failed to raise the siege.

When Washington joined his new command at Cambridge, he did so with consummate tact. Well aware that the crusty New Englanders would resent a Virginia general, he exerted his authority slowly, carefully, but firmly. At the outset of the war, many units refused to recognize the orders of officers from other Colonies. Patrick Henry had been first to voice the concept: "The distinctions between Virginians, Pennsylvanians, New

Yorkers and New Englanders are no more. I am not a Virginian, but an American!"

In the lines before Boston, the Rebels maintained the pleasant fiction that they had not risen against their sovereign, but rather against his stubborn ministers and a tyrannous Parliament. Dispatches referred repeatedly to the British garrison as the "Ministerial Army"; the flag flown above the American units bore 13 red and white stripes and—in the canton, where the stars are now—a Union Jack; each evening Washington and his officers dutifully toasted the king's health.

WASHINGTON established his authority largely through the power of his personality. Virtually everyone who met him found him charming, dignified, magnetic. Abigail Adams, who met the entire pantheon of the Revolution and approved of few, was "struck" with Washington. To her husband, John, she wrote: "You



had prepared me to entertain a favorable opinion of him, but I thought the one half was not told me. Dignity with ease and complacency, the Gentleman and Soldier look agreeably blended in him. Modesty marks every line and feature of his face."

Another friend recalled: "There was so much native dignity in his deportment, that no man could approach him without being impressed with a sensation that he accosted a superior being: yet there was a small mixture of timidity in his general demeanor, lest he might commit an error, and this modesty was exceeding prepossessing. It gave a mildness and kindness to his manner. . . ."

At Boston, Washington and his generals concluded that the key to victory was Dorchester Heights. Inexplicably, neither side had occupied this decisive position. Washington possessed the will to do so, but lacked the guns to hold it.

Then, at the beginning of 1776, plump Gen.

"What an infamous method of carrying on a war!" a British soldier complained about Rebels who sniped from behind trees and fences, as in this reenactment at Pound Ridge, New York. Washington often employed skirmishes, raids, and withdrawals to avoid a general action with the largest British expeditionary force of the 18th century. One of his greatest achievements lay in keeping citizen-soldiers—no matter how ill fed, poorly clothed, and prone to desertion—together as an army, and ready to strike when the opportunity arose.

Henry Knox—a former bookseller—completed a miracle. With a small, dedicated force, he dragged, wheeled, and sledged the 59 pieces of British artillery captured at Ticonderoga across 300 miles of bleak New England mountains. On the night of March 4, Americans wrestled some of the precious guns to the top of Dorchester Heights. As dawn broke, the muzzles stared down upon the exposed British positions. The British commander, Gen. William Howe, realizing that he had been outgeneraled, packed his army aboard a waiting fleet and sailed for Halifax, Nova Scotia.

JUBILATION SWEEPED the Colonies—but all too briefly. With Boston freed, Washington's troops wheeled southward toward New York to face a British invasion fleet.

As everything had gone right for Washington at Boston, so did it go wrong for him at New York. The British defeated him on Long Island and Manhattan and at White Plains. They went on to take Fort Washington with 2,800 defenders and invaluable stores, and then took strategically important Fort Lee on the New Jersey shore.

Washington herded the stunned remnants of his army across New Jersey, Redcoats in hot pursuit. A British officer noted that "many of the Rebels who were killed . . . were without shoes or Stockings, & Several were observed to have only linen drawers . . . without any proper shirt or Waistcoat."

The commander in chief was as dispirited as his troops. He wrote to a cousin: "Our only dependence now is upon the speedy enlistment of a new army. If this fails, I think the game will be pretty well up. . . ."



"We will have them directly," shouts Washington, sword in hand, at the Battle of Princeton, New Jersey. Reining in only 30 yards from the Redcoats, he gives the

By the time he reached the relative safety of Pennsylvania, Washington's army had shrunk from 30,000 to 3,400 men. Many, he recorded, were "entirely naked and most so thinly clad as to be unfit for service."

Despair seeped through the Colonies like a miasma. Where now the facile triumph of Ticonderoga? The blazing victory of Boston? Reality lay in Washington's ragged, defeated Continentals. New Jersey had seen firsthand the pitiful state of the retreating army, and citizens by the thousands hastened to declare allegiance to the Crown.

But reinforcements and supplies began to trickle in. From a nadir experienced by no other American commander in history, the general thanked Pennsylvanians for "old Cloathes for the use of the Army."

Like a later general from Virginia, Robert E. Lee, Washington was at his best when the stakes were high. So he gambled. On Christ-

mas Day, 1776, with dazzling audacity, he marched ill-armed, ill-clad troops to the banks of the Delaware some nine miles above Trenton. There at McKonkey's Ferry waited John Glover's immortal seafaring men of Marblehead, Massachusetts. In tubby boats meant to carry iron ore, they ferried 2,400 Americans across the ice-clogged river to the Jersey shore in the dead of night.

For Col. Johann Rall's Hessians, it was a night of wassail. Snug in their Trenton barracks, they toasted the season and their march across New Jersey. While the Hessians celebrated bibulously, the Rebels advanced silently through the woods. The soldiers shuffled and stumbled through the snow; one man froze to death. At 8 a.m., a German sentry saw the Americans ghosting out of the woods and sounded the alarm. But too late.

Washington had ordered his troops "to use the bayonet. I am resolved to take Trenton."



1783 PAINTING BY JAMES PEALE, A PARTICIPANT IN THE BATTLE, PRINCETON UNIVERSITY LIBRARY

order to fire. After the first volley, the British flee. The surprise Rebel victory prompts a British colonel to write home, "They are now become a formidable enemy."

After a bloody charge, Rall lay fatally wounded; 900 mercenaries surrendered; several hundred more fled in disorder. The half-frozen Americans captured vast stores of weapons and supplies. "Luckily," reported a journalist, "they found some hogsheads of rum at Trenton, large draughts of which alone preserved the lives of many."

THE VICTORY SERVED General Washington's purpose exactly. Wrote one observer: "The joy diffused throughout the union... reanimated the timid friends of the revolution and invigorated the confidence of the resolute."

The following week found Washington once more on the attack in New Jersey. By a ruse he outflanked the main British force outside Trenton, fell upon the rear guard at Princeton, scored a victory, and pressed on to Morristown to set up his winter quarters.

The British retreated toward New York, and General Howe settled down for the winter. For His Majesty's other ranks, of course, the war in America presented a familiar, ugly pageant. They marched... they fought... they died—all for tenpence a day and a ration of rum. But for officers, particularly those who wore generals' epaulets, American duty included delicious perquisites. Excellent clarets and Madeiras arrived regularly from Europe. In the great cities, such as New York, Tories warmly entertained the heroes who defended them from their misguided countrymen. And young Loyalist ladies virtually swooned against the scarlet regimentals of their protectors.

Sir William Howe set the tone for his subordinates when he took as mistress one of the most gorgeous women in the Colonies, Mrs. Joshua Loring. Sir William appointed her complaisant husband to a well-paid post that



FROM THE PUBLIC RECORD OFFICE, LONDON; BRITISH EMPIRE. COURTESY BY PERMISSION OF THE COMPTROLLER OF HER MAJESTY'S STATIONERY OFFICE

Like a shining promise, the West always beckoned to Washington; he made a dozen journeys there. After scouting almost to Lake Erie, he drew this map (above) in 1754. Years later he sought to make the Potomac River navigable, to harness it to the "Trade of a rising Empire." After the war the Patowmack Company he headed skirted river rapids with canals such as this one (facing page), still flowing in Fairfax County, Virginia. Ever the civic improver, Washington invited Virginians and Marylanders to Mount Vernon to discuss interstate commerce—talks that encouraged the calling of the Constitutional Convention.

kept him traveling without respite. And, when the British occupied Philadelphia in the winter of 1777-78, two lovelorn officers advertised in a newspaper for "A young woman. . . . Extravagant wages will be given, and no character required."

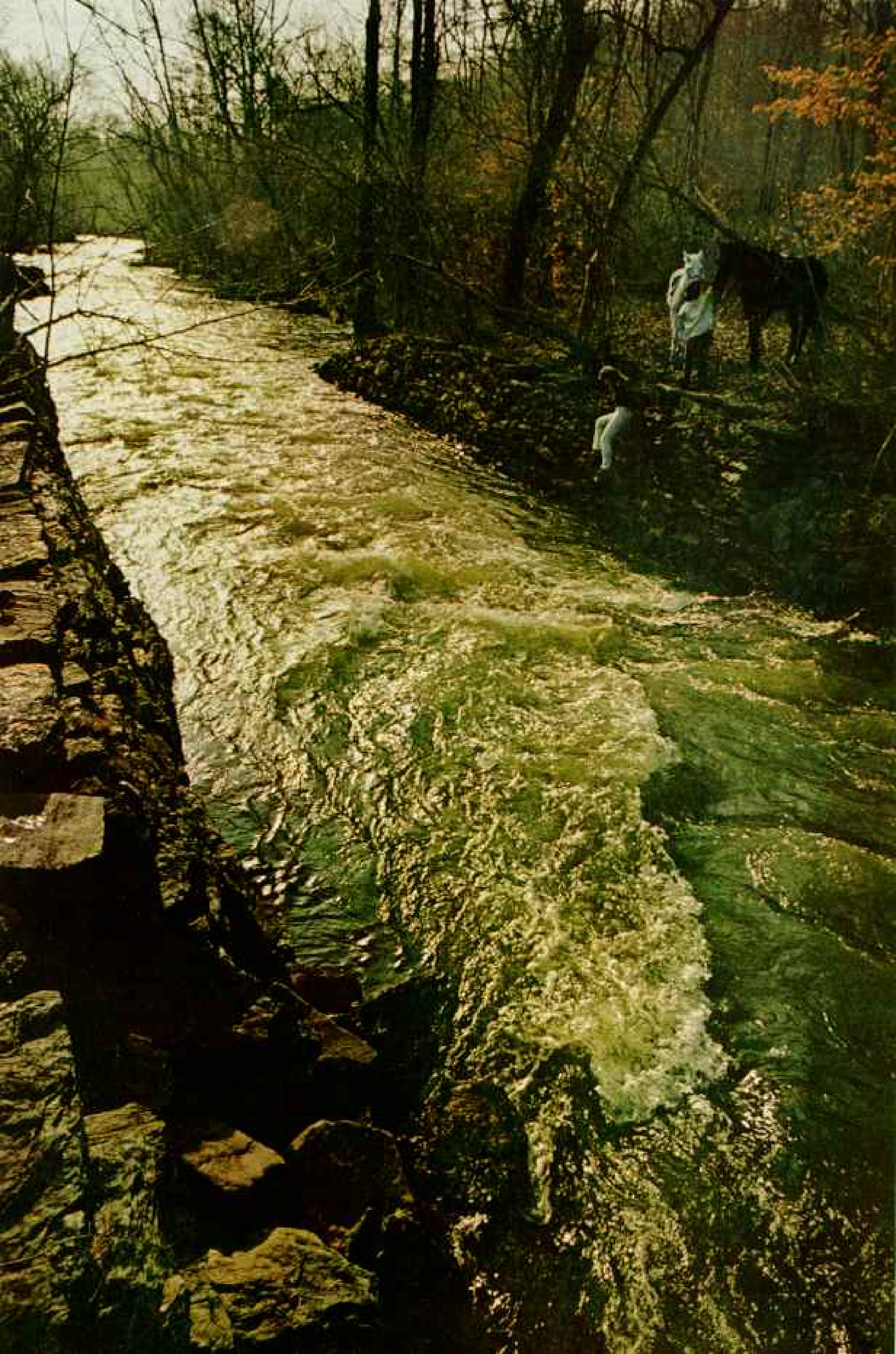
The year 1777 brought an influx of European officers into the American service—some motivated by love of liberty, others by love of high rank. Washington regarded most with impatience. Some, however, played vital roles. One, the Marquis de Lafayette—burning with enthusiasm—became a major general at the tender age of 20. Washington and the young French nobleman formed a deep attachment. To the commander in chief, Lafayette perhaps represented the child he had never fathered. Once he said, "I do not know a more noble soul, more honest, and I love him as my own son."

No one can measure the debt America owes to the expertise and courage of the European volunteers: to Louis Duportail, an ingenious fortifications designer who became chief of engineers in the Continental Army . . . to the Pole, Tadeusz Kosciuszko, who designed the entrenchments at Saratoga . . . to the Bavarian, Johann Kalb, who stood and fought and died at Camden as his blundering general fled the field . . . to the Prussian drillmaster von Steuben, whose tireless efforts transformed the American army from an awkward swarm of volunteers into formations that could maneuver on any battlefield. A gallant band, they paid hard dues for the millions of their compatriots who would flock to the United States in centuries to come.

Autumn 1777 saw Howe's army advancing on Philadelphia. Washington's Continentals intercepted them at Brandywine Creek. Once again Howe rolled up the American flank and inflicted a solid defeat. Lafayette fell with a bullet in the leg. At leisure, the Redcoats seized the American capital, Philadelphia.

In October 1777 Washington daringly attacked Howe's principal encampment in the suburb of Germantown. The Continentals—advancing out of a fog—envisioned a stunning victory but, at a crucial point, panic swept the troops and they fled.

On the heels of this defeat came news of a tremendous American victory at Saratoga. Maj. Gen. "Gentleman Johnny" Burgoyne had come to grief as he attempted to split the





WALL HANGING BY UNKNOWN ARTIST AFTER

Triumphant liberator, Washington enters New York City on November 25, 1783, after leading the first modern revolution against imperialism. A star-spangled banner waves

from the balcony of Federal Hall. There, six years later, Washington was inaugurated President of the United States. He shaped the office to priorities that have survived



AN 1930 LITHOGRAPH, COURTESY ROCKEFELLER FOLK ART COLLECTION, WILLIAMSBURG, VIRGINIA

nearly two centuries, championing federal union over sectionalism, Presidential direction of foreign policy, and peace through military preparedness.

Colonies by driving from Canada to Albany. To Gen. Horatio Gates, Burgoyne—perhaps the most likable of the British generals, although not the most competent—surrendered 5,000 troops, a pretty companion, himself, and his large traveling wine cellar.

THE GREAT VICTORY to the north focused the discontent of several generals upon Washington. Charles Lee pronounced his commander in chief “not fit to lead a sergeant’s command.” Even faithful Nathanael Greene had observed that the Virginian “does want decision.” Gates simply ignored Washington’s orders. Aided by a New England faction in Congress, a group of officers known from their loud, offensive leader, Thomas Conway, as “Conway’s Cabal” sought Washington’s dismissal.

The commander in chief, with his customary dignity, weathered the storm. The majority in Congress could conceive of no officer more dedicated to the principle of civilian control of the armed forces. When Conway did not cease his insults, one of Washington’s fiercely loyal generals, John Cadwalader, met him in a duel and shot him, fittingly enough, in the mouth.

Winter arrived early in 1777, and Washington decided to spend it at a place called Valley Forge. Logistical foul-ups had once again left the troops virtually destitute. So many lacked shoes that Washington wrote, “their Marches might be traced by the Blood from their feet. . . .”

Eleven thousand American troops of the line shuffled into Valley Forge. Before the cruel winter ended, some 2,500 had died of cold and deprivation; more than 1,000 had deserted; many had been court-martialed. Nonetheless, few American soldiers since have scaled the heights of glory attained by the shivering troops whose sufferings held the nation together in that woeful winter.

December. “I lay here two nights and one day and had not a morsel of anything to eat all the time, save half of a small pumpkin.”—Pvt. Joseph Martin.

February. “The situation of the camp is such that in all human probability the army must soon dissolve.”—Gen. James Varnum.

March. “The whole army is sick and crawling with vermin.”—Gen. Anthony Wayne.

The army survived, yet no visitor to Valley

Forge can escape those who died in that harsh bivouac. The elements that killed them now affirm their immortality: The snows that come with each December cloak their unmarked graves with fresh shrouds; the winds of every winter sing their requiem anew.

Spring came eventually to that grisly valley, and with it a premonition of ultimate victory: France entered the war as an ally of the Rebels. Faced with a possible French naval blockade of the Delaware River, British Gen. Henry Clinton abandoned Philadelphia.

Washington and the Continentals followed. At Monmouth, New Jersey, the commander in chief ordered Charles Lee to attack the British rear. Lee, spouting foolish and contradictory commands, turned a potential victory into a rout. His troops were in bewildered retreat when Washington thundered onto the battlefield. Officers close to Washington reported that this was one of the few occasions when the general was driven to profanity.

Lafayette, whose division had fought stubbornly in the swirling action, watched the general with awe as his presence stopped the retreat. And turned the tide. The young marquis saw Washington ranging "along the lines amid the shouts of the soldiers, cheering them by his voice and example and restoring to our standard the fortunes of the fight. I thought then as now that never had I beheld *so superb a man.*"

With the North, save for New York, in Rebel hands, the British turned their attention to the South. In the spring of 1780, they captured Charleston, South Carolina. But heavy losses incurred by Lord Cornwallis—despite a series of victories—persuaded him to march part of his depleted army to Virginia. There, joining British troops on the scene, he established himself at Yorktown. It was a final, fatal error.

The Washington who led the Yorktown operation was a far cry from the uncertain general of 1775. Tempered in the crucible of defeat, hardened by his generals' intrigues, he now commanded with crisp efficiency. In a

brilliantly coordinated march, Washington's Americans and the French regiments under the Comte de Rochambeau converged upon their prey. A French fleet under Admiral de Grasse beat up from the West Indies to interdict the mouth of the Chesapeake Bay.

As the British at Yorktown crouched behind their fortifications, the Continentals, professionals now, set up their lines alongside the French troops. The siege unfolded with the dramatic economy—and certainty—of a Greek tragedy.

Washington concentrated his efforts on the British left flank, protected by two outlying fortifications, Redoubts Nine and Ten. On the night of October 14, 1781, the French stormed Redoubt Nine; Lafayette's Light Infantry, with Col. Alexander Hamilton leading the assault, overran Ten, climaxing the last major offensive action of the Revolutionary War.

Cornwallis requested terms, and, on October 19, 1781, signed the articles of surrender.

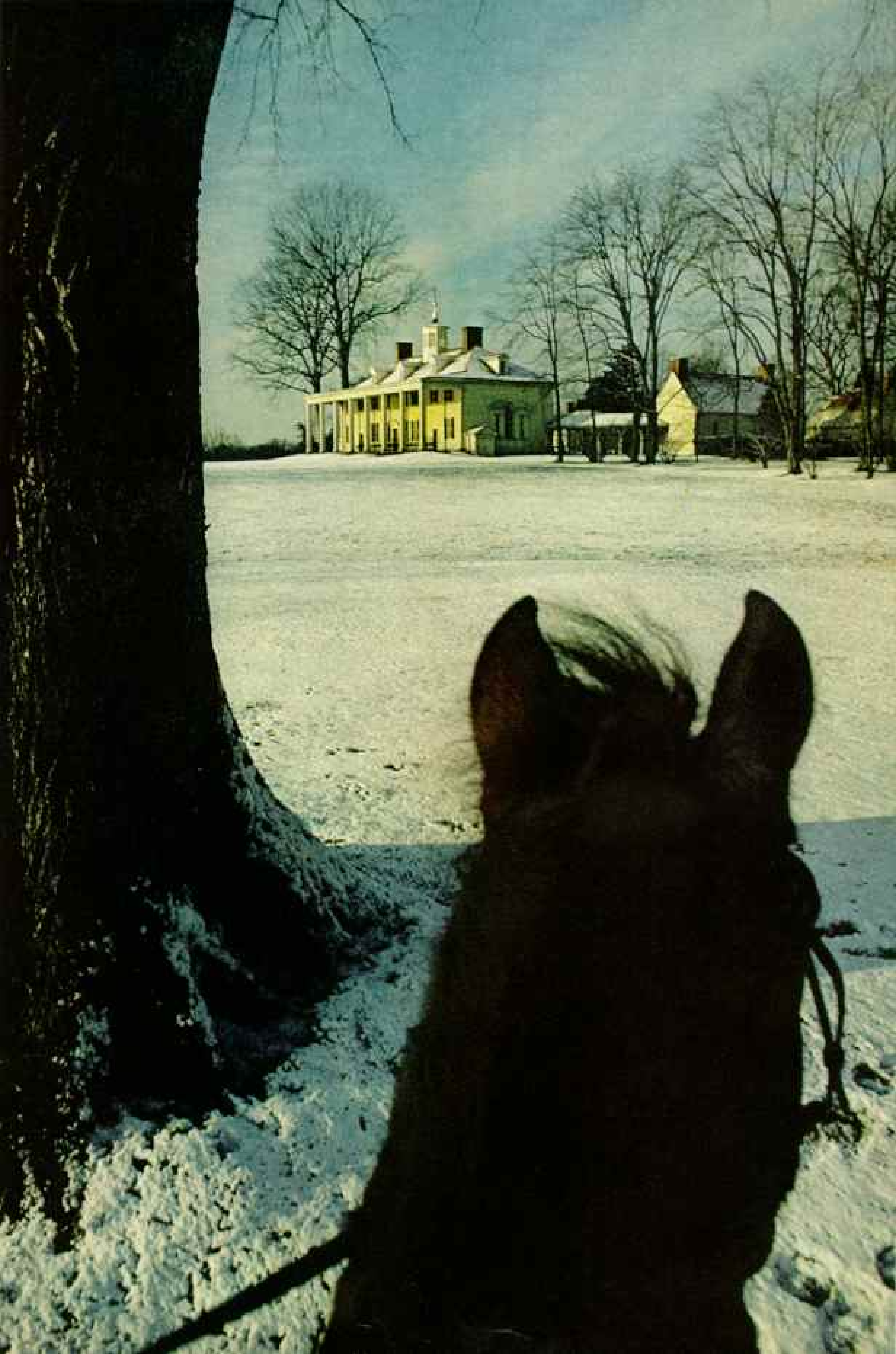
LATE ON AN AUTUMNAL afternoon, I stood on the rampart of reconstructed Redoubt Ten hard by the York River. The sun was dying behind a distant line of trees, flushing the western sky with a luminescence of orange and scarlet. As I walked across the rolling battlefield—the spell of war still haunting the gathering dusk—I switched on a cassette recorder.

A gay, jaunty 17th-century melody resounded with poignant irony across the old batteries and redoubts. Legend recalls that the British, with the battle lost, exercised a wry wit in selecting the march their fifers played as the proud regiments swung out of Yorktown to surrender their arms and flags—a tune called "The World Turned Upside Down," as indeed theirs was.

*If . . . summer were spring and I' other way round,
Then all the world would be upside down.*

When the Treaty of Paris officially ended the war and confirmed independence for

"Grandpapa . . . has already turned Farmer again," wrote Martha's granddaughter when her famous relative, after serving two terms as President, returned to his beloved Mount Vernon in 1797. Resuming his gentlemanly interests, he rode daily to inspect operations, a five-hour trip. But happiness was not to last. He developed a sore throat after riding his horse in a storm on December 12, 1799; two days later he died at the then ripe old age of 67.



America, Washington—breaking with all historical precedent, inasmuch as Congress had briefly granted him dictatorial powers and at least one of his officers had offered to crown him king—resigned his commission and returned to Mount Vernon.

Through the 1780's, the former general watched apprehensively as the bright promise of independence faltered in the shortcomings of the Articles of Confederation. His long wartime wrangles with the inefficient Continental Congress had convinced him that only a strong central government could assure national survival. So when a convention met in Philadelphia in 1787 to revise the Articles, Washington dutifully attended, and also served as President.

From this meeting emerged the Constitution of the United States. Subsequently, Washington became its defender as the first President of his country. The former commander in chief answered the bugle reluctantly, yet he placed duty to the nation before all other considerations.

On April 30, 1789, Washington took the oath of office. To his old artillery commander, General Knox, he confided that he faced "an Ocean of difficulties, without that competency of political skill, abilities and inclination which is necessary to manage the helm."

Still, he managed. A confrontation with Massachusetts Governor John Hancock settled a key issue once and for all: The President of the United States outranked any governor. Washington realized acutely that everything he did would affect history. "...I walk," he said, "on untrodden ground. There is scarcely any part of my conduct which may not hereafter be drawn into precedent." To the good fortune of the new nation, the

example that Washington set was to its benefit.

His high office brought him little joy. He confided, Thomas Jefferson said, that it represented "the extreme wretchedness of his existence." Yet he served conscientiously, and the institutions and practices that he helped to form have served the Republic for almost two centuries.

Historian Samuel Eliot Morison summarized Washington's merits as the nation's first President: "Washington was more nationalist and less provincial than any other American of his generation. His army experience had given him intimate knowledge of men from all parts of the country and the ability to size them up, and get along with them. Like some of his ablest successors, he wisely used the qualities of able men while ignoring their faults. Thus, he could put up with Hamilton's insolence and Jefferson's indirectness, because he needed their virtues and capacities to help run the government."

At the expiration of his second term, Washington stepped down without regret to pass his last years as a private citizen on his beloved plantation.

WASHINGTON DIED with his century. On December 12, 1799, he took a chill and, on the night of the 14th, he expired. Even on his deathbed he displayed the exquisite consideration for others that had marked his public life. Toward the end, he said to the attending physician, "I feel myself going. I thank you for your attentions; but I pray you to take no more trouble about me; let me go off quietly..."

He did, and church bells tolled mournfully across a nation that owed its very existence to the nobility of his nature. □

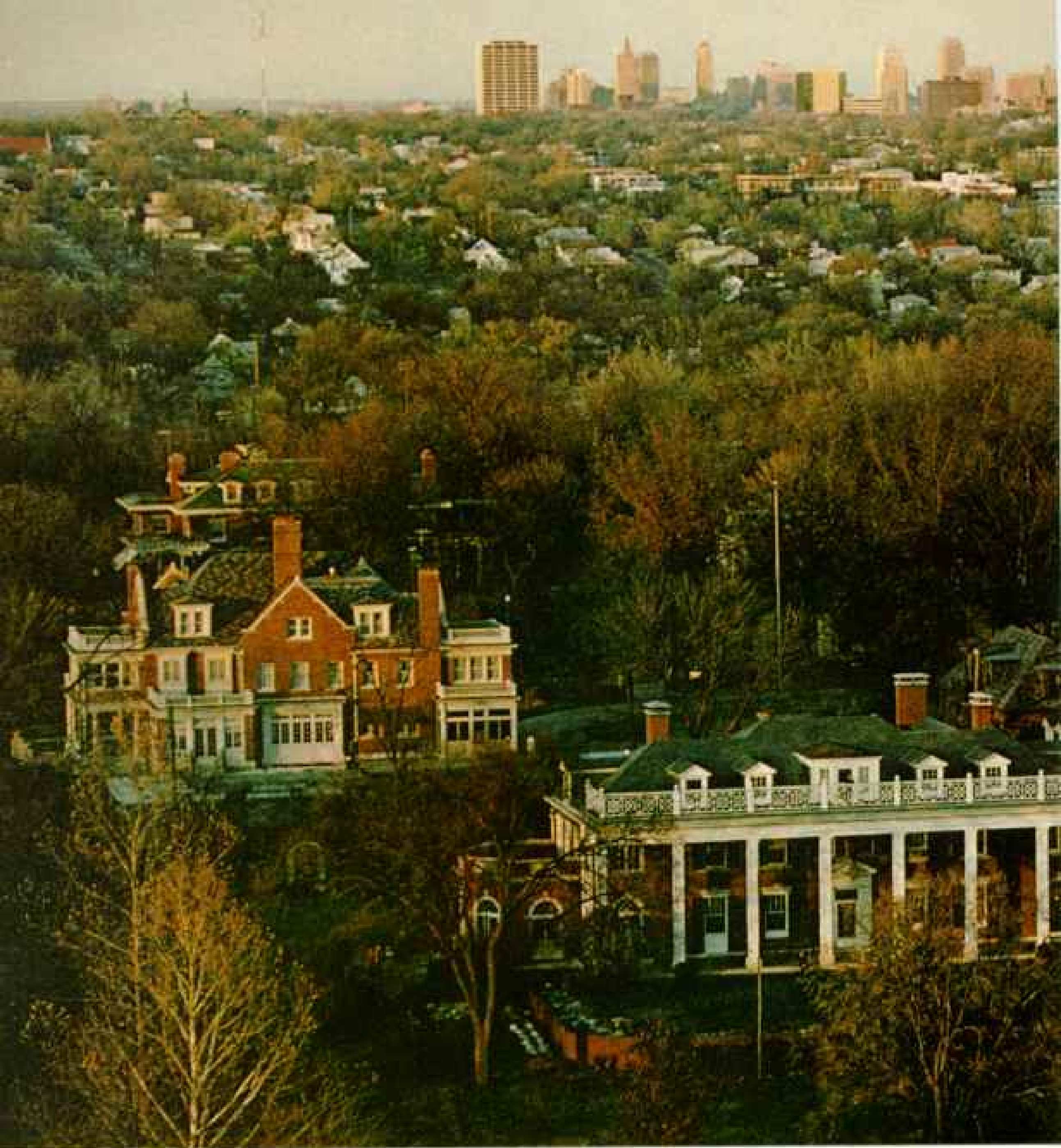


Glorification increased soon after Washington's death. A Philadelphia artist-engraver showed the hero being lifted to heaven by Time and Immortality (right). In the 1810's British minters struck tokens (left), much like today's Bicentennial souvenirs. In life Washington shunned vain-glory that smacked of monarchy. "I want an *American* character," he declared, "that the powers of Europe may be convinced we act for *ourselves* and not for *others*..."



COMMEMORATION OF WASHINGTON.

WILLIAM C. CLEMENTS LIBRARY, UNIVERSITY OF MICHIGAN LIBRARY. IMAGE COURTESY J. E. FIELD



Mansion-rich, skyscraper-high, greater Kansas City draws from mid-America's

Kansas City, Heartland U.S.A.

By ROWE FINDLEY SENIOR EDITORIAL STAFF
Photographs by TED SPIEGEL BLACK STAR



bounty to create a way of life that realizes the very dream that drove pioneers west.

MAYBE IT'S THE SETTING. Here the last Ice Age gave the Missouri River a mighty bend, and the wide Kansas River curls in from the west. The broad valleys are alive with man's industry. Downtown skyscrapers cluster cathedral-like on the bluffs above, all gold and shadow-blue in the late sun's low rays, or float like an island in the sky when morning mist lies flat like a sea.

Maybe it's awareness of the history made here. This was the head of both the Santa Fe and Oregon Trails, a New Zion for migrating Mormons, last-fling town for forty-niners, and site of a pivotal Civil War battle.

Whatever the reason, I sense a special excitement in Kansas City—an excitement shared by most people who live here; an excitement as old as mid-America itself.

Contrary to widely held beliefs, Kansas

City is neither flat nor somewhere west of Wichita. It's an up-and-down town with, as one visitor said, "more hills than Rome," and it sits astride the Missouri-Kansas line. Nor is it truly one town, but a contiguous mosaic of 50 municipalities in six counties, centering on Kansas City, Missouri (map, page 118).

There's hardworking Kansas City, Kansas, to the west, with its grain elevators and rail yards and oil refinery; then there's affluent, suburban Johnson County, Kansas, with its thousands of acres of quality homes. There's historic Independence to the east, Jackson County seat and hometown of Harry Truman; and historic Liberty to the northeast, Clay County seat and stomping ground of Jesse James. Toward other compass points the checkerboard of towns reaches into Cass, Platte, and Wyandotte Counties.

In all, the greater city's 724-square miles—home to 1.3 million people—encompasses a 40-mile sweep of landscape, an area so big that the weather service at times issues different forecasts for north and south.

Passions Include Jazz and Football

This cornucopia city still makes most of its living by funneling food to the world (and supplies to the farmer) over its dozen rail lines and by truck and barge. But its enterprise is also incredibly diverse: It makes frocks, researches cancer, assembles more automobiles than any city except Detroit.

It's a city that works hard and plays hard, suffering football fever with the Chiefs, supporting pro basketball and baseball and hockey; a city that likes its jazz swinging, its opera both light and grand, its steaks rare, and its summer theater in the park.

I went home to Kansas City recently to look up old friends, make new ones, and re-discover the town I'd known in the fifties; when I wrote for the *Kansas City Star*.

I found that the city's list of deeds and doers has grown fast in the last decade: Some

With will there's a way, Kansas Citians believe, and prove it with a booming industrial and mercantile life, a transformed civic face, and a robust spirit often nourished by faith. Here General Motors workers devote a lunch break to prayer for a troubled brother, imparting strength to him by the Biblical laying on of hands.

5.2 billion dollars in improvements—city, county, and privately funded—have been launched. From 1963 to 1971, a tall, soft-spoken lawyer named Ius W. "Ike" Davis presided over much of this dynamic growth from the 29th-floor mayor's office atop the Kansas City, Missouri, City Hall. The momentum continues under his successor, Mayor Charles B. Wheeler, Jr., a doctor of medicine and law. The list includes a three-terminal jetport; expressways; expanded medical complexes; urban-renewal projects; a convention center; side-by-side county stadiums



for pro football and baseball; a new arena to house pro basketball, hockey, the American Royal Livestock, Horse Show, and Rodeo, and—next month—the Republicans when they meet to name a Presidential candidate.

If Kansas City Likes It, So Will the U. S.

"These projects cut right across politics and boundaries and social groups to draw in a lot of people outside the government," Ike Davis told me. He pointed out, too, that the city's ethnic and economic patterns closely match the nation's: "We're a cross section of

America, a good testing place for new ideas."

An ethnic cross section means minorities, and Kansas City's minorities, like the nation's, have problems. And that, in the opinion of Alvin Brooks, who is an assistant city manager and who is black, gets us to the flaw in the city's character.

"You can get a tremendous commitment here for a new stadium project," he said. "You have a much harder time getting commitment to tackle the city's social problems." He cited minority housing, education, job opportunities, and school busing. Racial imbalance

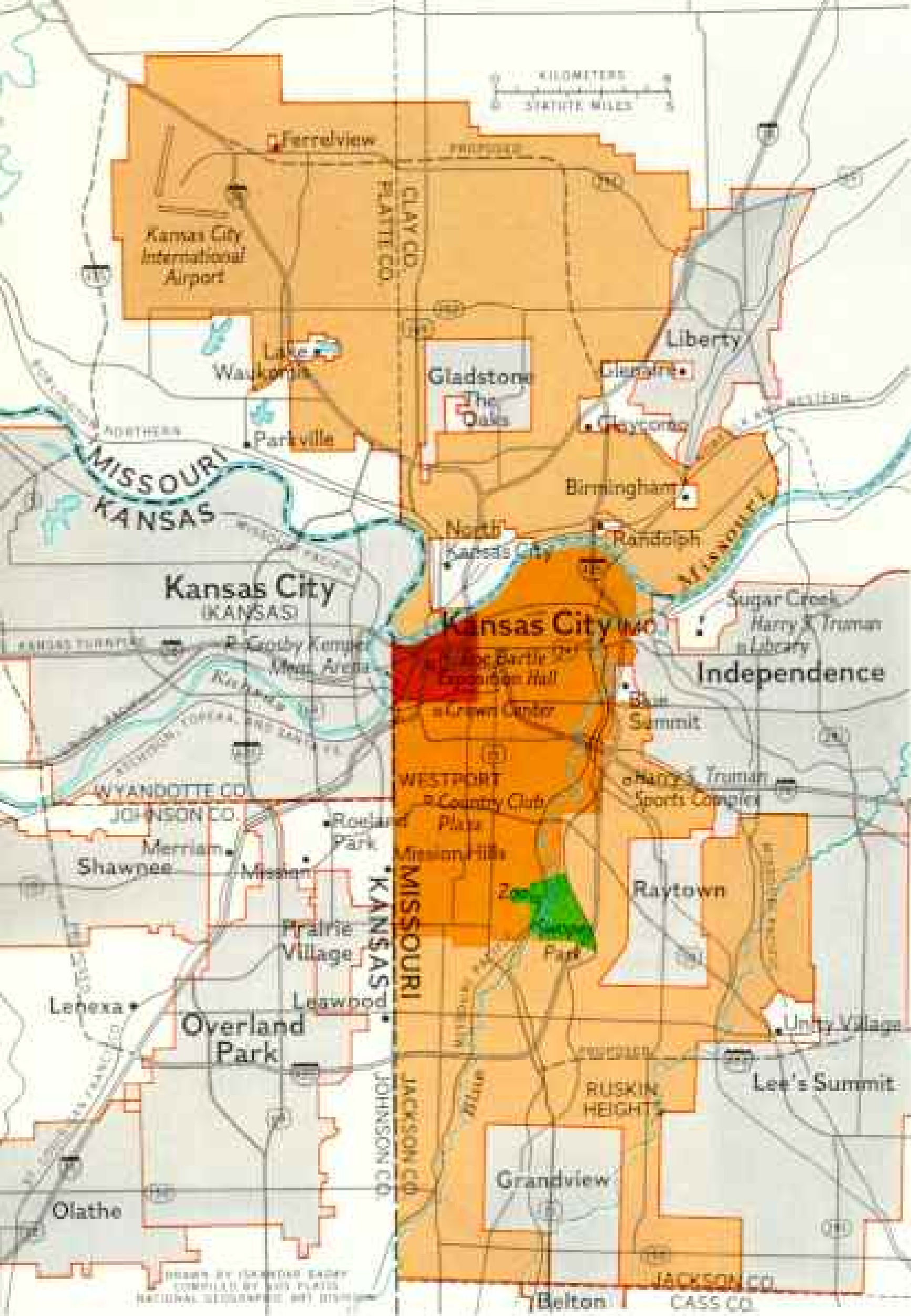






Eyes on glory, Kansas Citians welcome seasonal epidemics of sports fever. Youngsters clutching free baseballs vie for the autograph of Royals star George Brett (left), a leading American League hitter last year. At Southeast High, an aspiring back (above) leans into a practice run—perhaps hoping one day to play for the Kansas City Chiefs. After the Chiefs' trip to the first Super Bowl in 1967, Jackson County built the 71-million-dollar Harry S. Truman Sports Complex (below), with its twin stadiums—one for football, one for baseball.





How Kansas City grew

■ 1873 ■ 1909 ■ 1976

Gray shows other major municipalities included in greater Kansas City.

Straddling two states and six counties, greater Kansas City claims 1.3 million people in 50 municipalities covering 724 square miles. Its urban sprawl can be seen from 570 miles in space—at coordinates M-19 on the satellite map of the contiguous 48 states, *Portrait U.S.A.*, distributed with this issue.

The Missouri River's great bend ordained the city's destiny. Here a century and a half ago, traders and then homesteaders left steamboats for overland travel to the West, spawning lusty trail-head towns. Today the metropolis is a pacesetter among U.S. cities.

exists in the school districts of both Kansas City, Missouri, and Kansas City, Kansas. The situation may lead to school or court plans for busing into adjoining districts.

The city has its problems, it's true, but I found optimism pervading the darkest discussions. "It's a spirit that presumes a problem can be solved," explained Dr. Charles Kimball, president of Midwest Research Institute from 1950 to 1975, and now its chairman. A native of Boston, he raised fledgling MRI to national renown—and became an early exponent of the city's effervescent outlook: "It's an attitude that regards a crisis as a challenge of grit and imagination."

These two qualities were in demand here 150 years ago, when this metropolis was only a couple of lonely trail-head towns on the road to Santa Fe. My guide to the trail, local historian Pauline (Polly) Fowler of Independence, lives on Santa Fe Road.

"It's no coincidence," she said. From a meadow beside the road, she pointed: "This was part of the original Santa Fe Trail." In the rays of an early sun I saw a shallow trench that angled down a grassy slope, crossed a pasture, and vanished into a thicket.

The trail became a highroad beginning in 1821, when traders found rich profits in packing goods to adobe Sante Fe, in newly free

Mexico. Soon the Missouri's great bend became the jumping-off place for overland travel, and outfitters flourished at Independence and Westport. These raw frontier towns would coalesce into greater Kansas City.

We followed the first few miles of the historic trail, after visiting the old log courthouse and stone jail in Independence.

"They needed a good jail long before they had one," Polly said. We talked of the 1830's, when thousands thronged in, queued at outfitters and smithies by day, crowded into gambling halls by night, drank, fought, went west with high hopes, or died of cholera.

For a few years early Mormons tried to make Independence a more godly place, and failed. Amid mounting violence, they moved to Illinois. Subsequently, some returned as the Reorganized Church of Jesus Christ of Latter Day Saints, now headquartered in Independence on the temple lot chosen by Joseph Smith. Its present head is the prophet's grandson, W. Wallace Smith.

"Hub of the Universe" for H.S.T.

But no name is more widely associated with Independence, Missouri, than that of President Harry S. Truman. In 1931, when he was Jackson County's presiding official, and was building the county's first good concrete roads, he declared that, for him, Independence was the "hub of the universe." When he left the White House in 1953, he hurried straight back to his frame Victorian home on North Delaware.

Randall Jessee, former NBC newsman and foreign service officer now turned farmer near Roosterville, remembers those days well.

"Mr. Truman's popularity was at a low ebb," Randall said over a farm noonday "dinner" of chicken and dumplings, hot biscuits, and homemade sorghum molasses served by his wife, Fern. "I figured the Trumans might be lonely, and I told Fern: 'I think I'll invite them to dinner.' She was stunned at the thought of cooking for a former President, and said, 'You can't do that!' But the next time I saw Mr. Truman, I asked him, and he said, 'When would you like us to come?'"

That was the start of a warm family friendship treasured by the Jessees. Randall told of a summer evening in the Trumans' backyard, when they were watching movies of the

Trumans' post-Presidential tour of Europe.

"The pictures showed Mr. Truman getting a degree at Oxford, in the red gown and that sort of beefeater hat they wear," he said. "Afterward my daughter, Jana, then 5, skipped up to him and said, 'Mr. President, you sure looked funny in that king's hat.' He chuckled, and I admonished her that you don't say Presidents look *funny*. So a bit later she said, 'Mr. President, you sure looked *silly* in that king's hat.' Soon Mr. Truman vanished into the house and came back completely clad in the Oxford robes. He picked Jana up in his arms and said, 'Any little girl so interested in the robes of Oxford should be able to say she's seen the real thing.'"

Now 350,000 people a year come to the Harry S. Truman Library in Independence to see the archives and mementos of his career. I parked among cars from 20 states, and went in to talk with Dr. Ben Zobrist, director of the library, about the upsurge in the late President's popularity.

"He appeals strongly to today's young people, and there are more and more of them among our visitors," Dr. Zobrist said. "I think they like his decisiveness, his way of cutting through the double-talk."

We had lapsed into present tense, as if the President were still here, as indeed he was. I paused in his Oval Office, faithfully reproduced, saw the piano he'd played in the White House, and chatted briefly with Miss Rose A. Conway, his longtime secretary, who was still busy doing paperwork for the Chief.

Good Roads Helped Build a Reputation

One question had long puzzled me: How did Harry Truman manage to avoid the taint of the Pendergast machine that gave him his start in politics? Col. Rufus Burrus, Truman's longtime friend, fellow reserve officer, and family lawyer, answered it for me:

"He had the ability to let people know where he stood. When he was building roads for the county, he let Tom Pendergast know his concrete companies should stay out of the bidding, and they did."

Many others lacked such forthrightness with "Big Tom," so that when his machine flew apart during the late thirties after a convulsion of exposés and trials, city and county had a bad case of public remorse and civic hangover. But it had been quite a party!

The Pendergast years form a scarlet chapter in the city's past—casinos, bookies, brothels. A history by *Kansas City Star* editors Richard B. Fowler and Henry C. Haskell, now retired, records that Big Tom objected to roulette, so one casino on the state line offered roulette in Kansas, booze in Missouri.

The Kansas City, Missouri, City Hall, the police department, and much of the Jackson County Courthouse served the machine first, the public second. When "Pretty Boy" Floyd and friends machine-gunned five men at Union Station in 1933, the killers lingered in town overnight with impunity. When election frauds resulted in four deaths at the polls in 1934, the *complainants* were arrested.

Pendergast seemed invulnerable to waves of outrage—until a federal tax-evasion conviction sent him to Leavenworth Penitentiary in 1939. His empire crumbled.

Jam Session Stirs Nostalgia

One legacy of the Pendergast years has not only survived, it has thrived and turned respectable, though it was born in the era's bars and nightclubs. Jazzmen know it as the Kansas City sound.

Orville "Piggy" Minor, who played trumpet with Count Basie, has mellow memories of those rollicking years.

"There was the Reno Club at 12th and Cherry, the Spinning Wheel and the Barley Duke, and dozens of others," he said.

We talked against the riff of a jam session at the Mutual Musicians Foundation, a time-stained little building at 19th and Highland in the black district. It was 2 a.m. on a misty July Sunday, and Orville's friends had gathered from playing gigs all over the city to have fun playing for themselves.

"We formed our own union in the 1920's, after the white union wouldn't let us join," Orville explained. It was a mutual-aid group, helping "down" brothers get up again. One brother it helped was Bill Basie. On a recent visit the Count said simply, "I'm home."

The years of playing it high and whistling have callused Orville's lip, but the jazz trumpet remains his life: "A wife is great, but music frees my mind." With a lot of other brothers, Orville hopes to realize a dream of seeing the historic little building become a jazz hall of fame.

Kansas City can claim to have spawned



From boogie to Brahms, the shared joy of music enlivens the city. Jazz trumpeters play in friendly rivalry at the Mutual Musicians Foundation (above), a living museum of the town's golden jazz age—the 1920's and '30's. In those years the foundation, then a black union hall, aided a young pianist known as Count Basie. Last fall he returned (far right) to greet old friends.

Native son Virgil Thomson (right), composer of symphony, ballet, and opera, came home recently for a performance of his works by the Kansas City Philharmonic.





one hall of fame already: the "Hallmark Hall of Fame," television's most honored dramatic program. It sprang from the sponsorship of Hallmark greeting cards, and hence from the mind of founder Joyce C. Hall, who first heard about that Kansas City spirit back in 1909.

"I had a successful little postcard business in Norfolk, Nebraska, and I was thinking of moving it to Omaha," he said. "But a traveling cigar salesman said, 'Omaha is all right, but you want to go to Kansas City.'" The salesman spoke glowingly of the city's vigor and growth, of its extensive new parks and boulevards, of how it had built a huge convention hall in just 90 days. "I knew that was the place for me," Joyce Hall said. At 18 the lanky six-footer came to town and founded the giant of the greeting-card industry. Today it employs 500 artists alone.

Trying to Save the Inner City

Mr. Hall's varied public services, including support of "People to People," a kind of private Peace Corps, have brought him many honors. But he remains basically the small-town Nebraska boy he once was, easy to visit.

I visited him at Crown Center, the privately funded \$350,000,000 project in urban redevelopment born in his mind. Downtown, around Hallmark's headquarters, grimy old buildings give way to bright new offices, shops, and apartments, clustered around courts and greenery (next page). There's a 20-story hotel, with a 60-foot waterfall in the lobby; it cascades down a limestone bluff, once part of an eyesore called Signboard Hill.

Since 1966 son Donald J. Hall has headed Hallmark and Crown Center, expanding the project: "We're trying to show what private funding can do to save the inner city."

Others have caught the vision. A few blocks north, 30-story City Center Square thrusts its six-sided tower skyward. Between it and the vast new H. Roe Bartle Exposition Hall, nearing completion, the historic old Hotel Muehlebach, many times host to Presidents Truman and Eisenhower, is modernizing to the tune of seven million dollars.

On the riverfront, around the old farmers' market, 19th-century brick storefronts brighten with paint and quaint watering places—The Boiler Room, Cindi's Bedspread, Yesterday's Girl—part of a rejuvenation called River Quay. Pedestrian malls with flowers

Can the mind conquer pain? At Midwest Research Institute, electrodes on a cancer patient (opposite) pick up specific brain-wave frequencies and muscle activity believed related to pain and make them audible. The patient monitors the sounds and tries to learn control of body processes that could alleviate painful sensations. Such studies help make MRI a leading center of research.



Buddha from 12th-century Japan finds a new spot in the Nelson Gallery of Art, on the site of the onetime home of *Kansas City Star* founder William Rockhill Nelson, who left millions to build an outstanding art collection. The reassembled Amida Buddha of gilded wood will grace the entrance to a new wing of the museum, known throughout the world for its Oriental treasures.

Brainstormers Dr. Charles Kimball, chairman of Midwest Research Institute, left, and Donald J. Hall, president of Hallmark Cards, Inc., right, lead a Chamber of Commerce committee, called Prime Time, to promote the metropolis as one of America's most livable cities enjoying the "prime of her time."



Visionary who succeeded, Joyce C. Hall (center photo, at left) founded a greeting-card business that became an industry leader. Then he turned his passion for quality loose in other fields, giving television a fine dramatic series—the Hallmark Hall of Fame—and city planners an example of the best in privately funded urban redevelopment—the \$350,000,000 Crown Center (below). Here skaters skim the ice terrace, in a square where ethnic festivals are held each summer. During Fiesta Filipina (facing page), a Moslem princess dances nimbly through a lattice of clashing bamboo poles.





and fountains try to lure people back downtown in Independence and Kansas City, Kansas. In old Westport, streets sprout gas lamps and shops refurbish in frontier decor.

South of Westport, on a steep hill now tiered with winding drives and gracious homes, men in blue and gray once fought and died in an often overlooked Civil War battle.

Henry Haskell can see that hill from his study window, and his mind replays the events of that fight in October 1864:

"If Gen. Sterling Price had taken Kansas City and Fort Leavenworth, the gate to the West would've fallen into Southern hands."

"Mr. Hick'ry" Helps Win a Battle

Almost 30,000 troops maneuvered, skirmished, and met head-on, with the Southerners finally digging in atop the hill, and holding. On the third day it looked like a stalemate.

Then a bent old man—some accounts call him "Mr. Hick'ry" for the staff he leaned on—showed the Union commander a hidden ravine leading to the top of the hill.

"Gen. Samuel R. Curtis wasted no time getting cannon and cavalry to the top," Mr. Haskell said. "They flanked the defenders, and the battle was won."

I well knew that once-bloody hill, now a city park. My wife, Virginia, and I often brought our boys to the playground there, next to a rose garden, where our favorite bloom was a saucer-size beauty called Peace.

The real scourge of the region in Civil War

days was the hit-and-run terror of guerrillas. That hate storm, fanned by abolitionist John Brown, nurtured outlaw Jesse James. I went to Liberty and asked Bill and Vera Eldridge about those times.

"Please say something about Liberty and Clay County besides Jesse James," Vera pleaded. Both she and Bill, who is county recorder of deeds, work tirelessly uncovering local history. "We're older than Independence, with elegant old houses, and William Jewell College, begun before the Civil War. We recently got a state preserve made of a wonderful old settlement called Watkins Mill."

But Jesse's father, a Baptist minister, helped found William Jewell College; legend has it that the James gang used to go to Watkins Woolen Mill for blankets, and that they launched their bank-robbing career in Liberty. So the talk always comes back to the James boys. But how did they get that way?

"This was an area of Southern sympathies," Bill said, "and some of these people had been kicked off their land by the infamous Order No. 11." Trying to stop bushwhackers, including the Jameses, Union Gen. Thomas Ewing in 1863 had ordered all settlers to evacuate an 85-mile-long band of Missouri on the Kansas border. Looting and burning by jawhawkers from Kansas ravaged the land.

Amazingly, for 16 years after the war Jesse and Frank and friends robbed trains and banks and eluded posses and Pinkertons. A bomb tossed into the James family home



killed Jesse's younger brother and cost his mother a hand.

Finally Jesse died, not at the hands of a lawman, but shot in the back by traitorous gang member Robert Ford, "that dirty little coward," in the words of the song.

And Clay County has yielded to its fate, each April staging a Jesse James Festival, re-enacting a bank robbery with a satisfying expenditure of blanks and flashbulbs.

Economic Wars Beset Minorities

Through the Civil War, Kansas City's ethnic face was Anglo-Saxon, with strong German elements. Then came increasing numbers of Jews, Irish, Italians, and Slavs. They shared the common problems of being poor and different, clustering in ghettos at first, gradually diffusing into the city's mainstream. Mexicans and blacks came too, and found bigger problems.

"My father fled Mexico in 1919, during a revolution," Lupe Gonzalez told me. "He got a job with the Santa Fe and came to Kansas City, Kansas, to work in the freight yards."

Lupe grew up in Argentine, above the yards and the packing plants along the Kansas River. I remember it for its modest frame houses, flowers, strings of drying peppers, the tantalizing smell of baking tortillas. "We had our saints' days and fiestas," Lupe said. "It was like a little piece of Mexico."

But he knew he wasn't in Mexico when he went to look for a job. There were barriers.

"If we made it through high school and went with the railroad or a packing plant, the Anglo community felt we should aspire to nothing more," he said.

Lupe tried college, varied jobs, and became local head of federally funded SER, Spanish for "to be." The program helps people find jobs by training them in English and specific skills. Lupe feels things are looking up.

Bernard Powell fights housing barriers in the black community of Kansas City, Missouri. More than 100,000 blacks live in a 2,240-block expanse that ranges from well-kept mansions to houses and apartments that look like artillery targets.

"Battles *have* been fought here, but they're economic battles," said Bernie Powell, who heads a coalition of civic groups called the Social Action Committee of Twenty. "People lack the money to make repairs."

He mentioned a practice called redlining, by which deteriorating areas are denied home loans. "We help people who have run out of options," he said. When I saw him, he was sending shingles to the Olive Street home of Mrs. Evelyn Hopkins, 79, and VISTA volunteers were nailing them to her leaking roof.

"We'll work with anybody who will help restore any part of this town," said Bernie, at 28 an eight-year veteran of such work. "We just ask people to do what they can. If you're a homeowner, put on some paint, one can at a time, if that's all you can do. Plant a tree, a bush. If you haven't at least planted a

Depot for the world, Kansas City ships automobiles and envelopes, corn and pool tables by rail, river, and road. At Missouri River docks, a barge (left) takes on 45,000 bushels of hard winter wheat destined for export via the Mississippi and New Orleans.

In Trans World Airlines' jet-overhaul base (right) a Boeing 747 being remodeled for Iran's Air Force looms over a tiny bird of another era. Employee volunteers lovingly restore a 1930 Stearman-Northrop Alpha monoplane for the Smithsonian's Air and Space Museum in Washington, D.C.





Salvaging the past for the future, workmen along a black-district boulevard called The Paseo ready eyesore apartments for restoration (above). Stetsoned contractor Willis Jackson (below) lugs remodeling plans for another inner-city housing project, containing 136 units. Also bitten by last year's billion-dollar building bug, youths (right) fashioned this six-story tree house from scrap lumber in suburban Wyandotte County, Kansas.







Wrestling bucking hoses, volunteers try to save a blazing home during a four-day

tree or a flower, I don't want to talk to you."

Apartments and condominiums notwithstanding, the city is largely one of individual homes, with low population density. In the 50's and 60's, Kansas City, Missouri, almost quadrupled its area to 316 square miles, annexing a big bite from Platte County, to include the new jetport there.

"I have one patrol car covering 60 square miles in rural Platte County," Police Chief Joseph D. McNamara told me. "That's 60 times bigger than the precinct in Harlem where I used to walk a beat." From a New York City Irish police family, with a doctorate in public administration from Harvard, the 41-year-old chief succeeded Clarence M. Kelley, who moved to Washington in 1973 to direct the FBI.

McNamara has continued to stress better

community relations and closer rapport with blacks. And his department's emergency corps, whose specialty is rescuing hostages, has attracted national attention.

Shangri-la and a Vista of Spain

Rescuing people troubled in spirit draws attention to a unique Kansas City institution, a Christian movement called Unity, started in 1889. Amid a Shangri-la of cloisterlike buildings, orchards, and woods, Unity maintains a retreat center, global printing operation, seminary, and a 24-hour prayer vigil that receives 2,370,000 requests a year. "We stress the unity of all creation, including other faiths," says President Charles R. Fillmore, namesake and grandson of the founder.

Another Kansas City landmark—the Country Club Plaza—has been much studied



firemen's strike last fall. Police, servicemen, and youths teamed to meet the crisis.

across the nation for more than half a century.

The plaza, begun in 1922, was the nation's first major suburban shopping center. No antiseptic monstrosity of cold glass and concrete, it is mellow buff brick and red tile, with courtyards and fountains and towers copied from Spain. The plaza, covering 15 city blocks, is the dream of the late J. C. Nichols.

"My father believed that beauty should be part of everyday life, even a shopping trip," said Miller Nichols, his like-minded son, who heads the real-estate firm that owns the plaza. "In a time when outdoor privies were still common, he felt a backyard should be as attractive as a front yard. He promoted boulevards, curving drives, and fountains."

Such ideas distinguish 8,000 acres of housing developed by the firm, making southwest Kansas City and adjacent Johnson County,

Kansas, a showplace—one of the nation's greatest expanses of beautiful homes.

At Christmastime many twinkle with outdoor lights, as does the Spanish skyline of the plaza (pages 138-9). Last year some 70,000 came to watch the lighting ceremonies.

From our room atop the Raphael Hotel, Virginia and I looked down through the snowy evening to the festival of lights, the holiday crowd. From somewhere voices caroled "...tidings of comfort and joy..." and the fragment floated up into the snow-reflected brightness like a benediction on the night. Christmas had found us.

East of the plaza clusters the city's cultural heartland: the Nelson Gallery, the Art Institute, Rockhurst College, the Music Conservatory, the burgeoning University of Missouri at Kansas City.

"What am I bid? Fifty, do I hear sixty?" The come-on chant of the auctioneer sets the tempo for a city that thrives on buying and selling. At the Missouri Auction School, students (right) practice rhythm and style. "You can attend an auction in Kansas City any hour of the day," says President Richard W. Dewees, whose school teaches how to sell everything from Aberdeen Angus cattle to antiques. Like his 400 graduates each year, he is a "colonel," a title said to stem from the close of the Civil War when regimental commanders auctioned their unit's gear.



Amid a forest of waving arms, brokers of the Kansas City Board of Trade (above) shout bids that effect the selling of a billion bushels annually of hard winter wheat. Developed from seed brought by Mennonite immigrants from the Ukraine in the 1870's, the variety bore prodigious yields on the Great Plains and made Kansas the leading wheat state. Now the Soviet Union is buying it back.





Here, too, one finds the Linda Hall Library of Science, with its outstanding collection of scientific books and journals, and the Midwest Research Institute. The latter is now studying "biofeedback" as an aid to drug addicts and cancer patients (page 122). The greater city also has medical schools of the Universities of Missouri and Kansas, and half a dozen other institutions of higher learning.

The stone-pillared Nelson Gallery honors the granite-jawed founder of the *Kansas City Star*, whose alumni include William Allen White, Ernest Hemingway, and Ben Hibbs. Indianian William Rockhill Nelson founded the newspaper in 1880, crusaded for parks, boulevards, and municipal reform, backed Teddy Roosevelt for President, and left millions to acquire art for a gallery.

By the early 1930's, the gallery stood ready, but largely empty, on the commanding hill where the Nelson home had been. Trustees found the art of Europe and the classical world bought up and scarce, but the Orient was a different matter. In China they found young Laurence Sickman studying on a Harvard scholarship and asked him to buy art for them. Man and cause had met.

"In those days in China, you could stroll into a shop and buy a Han vase, a 3,000-year-old bronze horse, a collection of scrolls," Mr. Sickman told me. He sent the gallery sculpture, paintings, ceramics, furniture, a whole temple ceiling—the nucleus of what has become one of three or four great collections of Chinese art in the Western World. Then he returned to become curator of the treasures he'd found, and finally the gallery director.

Maverick Artist Perceived Nation's Spirit

Until last year Kansas City had a living art treasure in Thomas Hart Benton, an unexcelled muralist and eloquent maverick, who for a few years taught at the Art Institute. As a child he muraled the stairway of the family home in Neosho, Missouri; he left at 17 to study art. He offended gallery curators by questioning their manhood, and preferred creek-bank and barroom companions to the "vanities of society." His brush feelingly captured the frontier trapper and Missouri cornfield, the heartland and folkways of America.

In January 1975 he finished a mural on country music, shared a quail dinner with friends, then sat contemplating his latest

work—and his heart stopped after 85 vigorous years. "Kansas City misses him," said John W. Callison, a young stockbroker who had been his friend and companion on Arkansas float trips. "And I miss him, too."

Benton was essentially a workingman's painter, just as Kansas City has always been a workingman's town. During World War II it turned out munitions by trainloads, Pratt & Whitney engines, B-25 bombers, and thousands of landing craft that chugged down the Missouri to far-off bloody beachheads.

Suspense Marks a Launching

Harry Darby, former U.S. Senator and GOP National Committeeman, who helped persuade Eisenhower to run for President, remembers those landing craft well, because his Kansas City, Kansas, steel firm made them—and frankly, they looked so monstrous that he doubted the first one would float.

"When it did, I gave a cheer," he said, "and followed it by car for 25 miles downriver, where I gave it a salute and sent it on its way."

Today Kansas City sends out a stream of refurbished jetliners from its sprawling Trans World Airlines overhaul base at the new International Airport. On my way to see a huge Boeing 747 being rejuvenated, I was waylaid by a vamp of an earlier age, an innovative monoplane of the 1930's known as the Stearman-Northrop Alpha (page 127).

"Frankly, she's a mess now, but come back in a month," said Dan McGrogan, instructor in TWA's Kansas City flight-operations school. Dan's volunteer crew of TWA workers was restoring the Alpha for the Smithsonian's Air and Space Museum.

Only 20 Alphas were built, and TWA bought 13 of them. Air historians had supposed that all 20 Alphas had disintegrated, but this venerable specimen was found in Wisconsin. Dan's crew was rebuilding the landing gear and whole wing sections.

"I figure I saw this very plane go over my house near Pittsburgh when I was a boy," Dan said. The blue exhaust flames of the 10 p.m. mail plane inspired him to become a pilot and flight engineer. Now at TWA he teaches others the intricacies of giant jets.

Jet-age Kansas City remains faithful to its earlier history as a city of the harvests, especially of wheat and livestock. Two events in the 1870's started it on its way.

In the far-off Ukraine, pacifist Mennonite farmers feared conscription into the czar's armies, and when Santa Fe railroad agents from America offered homesteads, the plain people came by thousands, bringing with them precious bags of seed wheat called "Turkey red." In Kansas it ultimately bore prodigious yields, and Kansas City prospered as grain poured through it to the nation and to the world.

Today the Kansas City Board of Trade is the world's biggest marketplace for that red winter wheat, ironically the kind the Soviet Union buys when its harvests fall short.

Rod Turnbull of the Board of Trade makes the growing and selling and moving of grain sound like an adventure story: the plains farmer's double gamble with prices and the whims of nature; the golden harvest; the tall elevators showering their bounty into long trains; the tumultuous marketplace.

Mounting a horseshoe dais called the trading pit, grain brokers wave their arms like evangelists and shout bids, as federal law requires. Ignoring the barrage of bidding, Rod talked of a flurry of stories that the Russians had leased many ships, that a big grain deal was near. Next day came the word that the Soviet Union would buy two million metric tons of hard winter wheat.

By train, truck, or barge, grain moves in and out of Kansas City every day. One snowy day I watched towboat pilot Bill Cartwright nudge nine barges under a conveyor to load 380,000 bushels of No. 1 milling wheat.

"We'll get it to St. Louis in 40 hours," Bill said. "Some will go to New Orleans and overseas—some up the Tennessee to Chattanooga." Yes, he conceded, the Missouri can be mean. "It's swift and shallow, and the channel can change in hours." Stopping his 1,100-foot-long tow takes two miles—or more.

Recalling the Big Cattle Era

Wheat elevators and stockyards—that's a Kansas City I remember. From 2,000 pens in the West Bottoms an aroma on certain winds advertised livestock clear across town. Briefly in the 1940's the city surpassed Chicago as the world's biggest cattle market.

Vivid in my mind is a July day in the '50's when the rampaging Kansas River flooded the pens. Bawling animals were herded to rooftops, only to die in the scorching sun. Jay

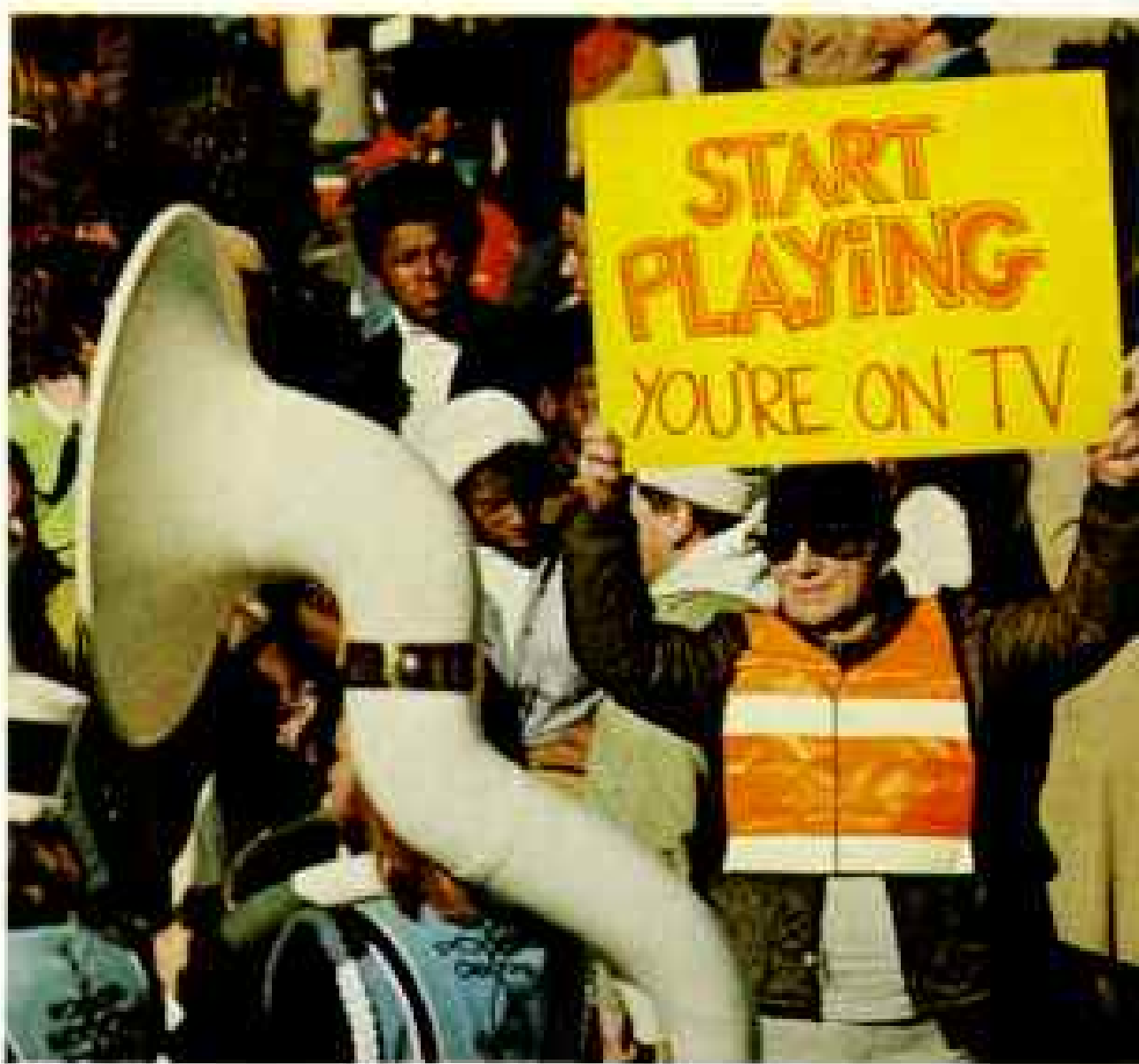
B. Dillingham, for years president of the Kansas City Stock Yards Company, was there, trying to save them: "With water all around, we couldn't get enough of it up to them to wet them down—and we couldn't shade them."

For both Jay and Kansas City, the livestock industry has been a life's theme. We talked of the vast herds of Texas longhorns driven to Kansas railheads in the early 1870's, giving the Kansas City livestock industry its real impetus. The railroads pushed west, and soon cattle came from Colorado, Wyoming, Arizona, together with ranchers and cowboys bent on kicking up their heels in the city.

"But the truck and commercial feedlot dispersed the industry," Jay said. Today's volume is less than half of the 1940's business.

If the stockyards aren't as big as they once were, the American Royal Livestock and Horse Show they produced is bigger than ever.

For 77 years there has been an American Royal in Kansas City. Last November it moved into the new Kemper Arena, added a rodeo, and drew a record quarter of a million people. Attendant events filled hotel lobbies and streets with stockbreeders in stetsons,



Command performance: Bands sound off on cue as they swing past television cameras in the three-hour parade honoring the American Royal Livestock, Horse Show, and Rodeo. The sign's other side directs units to mark time during ads or station breaks.



Grand event of a grand city: Equestrian aristocrats share the spotlight with prize farm animals in the 77th annual American Royal Livestock, Horse Show, and Rodeo. The cowboy contests were a first at last year's Royal, which drew a record quarter of a million spectators.

With a last-minute adjustment (left), a finalist prepares to bid for the championship in the equitation division, a test of classic riding form. High-stepping harness horses

(below) circle in the new Kemper Arena, which will be the scene of the Republican National Convention in August 1976.

Breeders from across the United States and Canada bring their prize livestock to the Royal. The exhibitor of the grand champion Polled Hereford accepts congratulations (lower left). Yvonne Sharon Roberts, Miss California Charolais (lower right), was one of several beauty queens representing various stockbreeder associations.

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belles in ball gowns, and 20,000 Future Farmers of America in blue-and-gold jackets.

"This town really jumps during the Royal," said Bill Harsh, president of the 1975 event. "Make your reservations early, arrive early, and have fun." We did all of the above.

In the bunting-hung Kemper Arena, we cheered proud show horses with sequined hooves: roached-maned three-gaiteds; Appaloosas, Arabians, Morgans. When the jumper's dug into the tanbark to spring over six-foot jumps, my heart went up with them.

We shared the pride of 14-year-old Celia Harmon of Clinton, Missouri, when her Galloway heifer won the reserve championship. We knew she had been up since dawn, shampooing HA Boy's Gal 331, spraying on Patterson's Purple Oil for glow, a mist of peach balm for sheen. She'd aimed for the grand championship, but "there's always next year."

We shared the concern of the Jack MacNairs, Kansas "Farm Family of the Year," at the Royal, for the 700 heifers they'd acquired just before coming to Kansas City. An early blizzard was sweeping their farm, near Jetmore. "But we've got good help, and good neighbors," Jack and wife Bobbie kept assuring me—and each other.

Weather's Tricks Keep City Watchful

Blizzards, floods, droughts, and twisters: They are all part of that special—sometimes disastrous—excitement that pervades Kansas City. I remember a 1957 twister that struck suburban Ruskin Heights, killing 44 people in its path, injuring 200, reducing blocks of homes to rubble. Until it veered, that storm had aimed straight at our house. Like other Kansas Citians, I learned to keep an eye on the sky, an ear on the weather forecast.

Merry as the bells that peal from its tower, as mellow as old Seville, the Country Club Plaza celebrates Christmas. The nation's first major suburban shopping center,



That's why, among 21,600 civil servants who staff the federal regional offices here, chief weather forecaster Allen Pearson is the most famous. I sought him out.

"Every time they run *The Wizard of Oz* on TV, and that twister carries Dorothy clear out of Kansas, we get tornado inquiries," he said. Pearson also heads the National Severe Storms Forecast Center, headquartered here.

In his office high in the new glass-and-concrete Federal Building, we hunched over a U. S. map and focused on the Great Plains. He explained that warm moist Gulf air and colder Canadian air sometimes collide in the lee of the Rockies with catastrophic results.

"The funnels that get photographed are usually not the meanest ones," he said. "The really dangerous ones are too often masked by rain. For them we hit the panic button, and we hope you will pay attention."

The skies that occasionally brew death more commonly bestow the sun and rain that produce bounty. "We're at the heart of the world's biggest larder—Missouri, Kansas, Iowa, and Nebraska," notes Fred Kiewit, agriculture editor of the *Star*. "This assures Kansas City a commanding role in the future."

Seeking a path through guessed-at country to the west in 1804, Lewis and Clark paused at the Missouri's great bend and noted its commanding bluffs. On one of those bluffs, I now gaze over the greater city and ponder its path through guessed-at country called the future.

No one can read in that roiling swift water what is yet to come, of course. But knowing this place as I do, I'm certain of one thing: In years ahead we'll see more, not less, of that special excitement—that special spirit—in this place called Kansas City. □

begun by the late J. C. Nichols in 1922; drew inspiration from Spain, with fountains, sculpture, courtyards, and wall mosaics to make shopping a time of pleasure.

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Landsat Looks at Hometown Earth

By BARRY C. BISHOP

NATIONAL GEOGRAPHIC STAFF



NATIONAL GEOGRAPHIC PHOTOGRAPHER JOE BAILEY

Unprecedented portrait combines 569 color images to form a virtually cloudless view of the 48 contiguous states. Recording both visible and invisible light, Landsat reveals details beyond the scope of conventional aerial photography. Here General Electric's Tony Rossi blends join lines of two of the color prints.

FOURTEEN TIMES every 24 hours it girdles the globe, silently scanning, measuring, collecting, and sending back to us a greater overview of our planet than any earthbound eye can see, more information than the human mind alone can comprehend.

Synchronized with the sun, it swings in a near-polar orbit hundreds of miles above the earth. At the Equator each pass is some 1,800 miles west of the previous one. Every 25 seconds it scans an area the size of Massachusetts and Connecticut.

This is Landsat 1, launched July 23, 1972, with an expected working life of one year. Nearly four years later—to the delight of both its designers and users—it is still gathering earth resource data on a global scale; it was joined on January 22, 1975, by Landsat 2. The twin satellites have since been systematically passing over virtually every point on the globe once every nine days.

Though technically still in the research and developmental stage, the Landsat program already has paid incalculable dividends. One dramatic result is the first coast-to-coast color photomosaic of the 48 states. This remarkable 10-by-16-foot picture is reproduced as *Portrait U.S.A.*—a map supplement to this issue, distributed as a Bicentennial salute to the nation.

On its reverse side the supplement bears the Society's latest political map of the United States, drawn to the same scale.

Billions of "Pixels" Beamed to Earth

Landsat does not use photographic cameras but an ingenious instrument called a multi-spectral scanner, or MSS. The device uses an oscillating mirror that scans the earth and a telescope that focuses visible and near infrared light waves reflected from the earth into the satellite's radiation detectors, which measure the light intensities of 1.1-acre picture elements, or "pixels," in four different spectral bands (diagram, page 142). These values are converted into computer-digestible numbers and transmitted back to earth at the rate of 15 million units each second.

Through an electron-beam recorder, this stream of data becomes imagery on photographic film, which, in turn, can be put to a variety of uses.

More than a year ago NATIONAL GEOGRAPHIC decided to team the National

Aeronautics and Space Administration's Landsat imagery and the General Electric Company's color-mosaic expertise with the Society's map program. Since the satellite orbits at a height of 570 miles, its images are free of most of the distortion found in lower-altitude aerial photographs. The viewer sees any point on an image almost as if he were looking directly down at it. This allows for high accuracy when matching the overlap of two images.

"Before Landsat imagery, it would have been impracticable to make such a mosaic," said Tony Rossi, head of General Electric's Photographic Engineering Laboratory in Beltsville, Maryland. "Using aerial photography from 60,000 feet, we would have needed more than 28,000 photographs. **Portrait U.S.A.** required only 569 satellite images."

Rossi and his staff screened more than 30,000 images taken during 3,500 orbits in late spring, summer, and early fall between 1972 and 1975. They finally selected 700 potential scenes—clear and virtually cloud free.

For four months the technicians pieced together portions of images—each covering 115 miles on a side—into 16 regional mosaic views; almost 8,000 color prints contributed to the best possible color match and almost invisible join lines. Each regional mosaic was rephotographed with a huge custom-made camera on special color film 40 inches square. When the regions were united, the photomosaic measured 10 by 16 feet.* From this billboard-size mural, the Society's Cartographic Division produced **Portrait U.S.A.**

Dramatic as it is, this unique photomosaic is but one of Landsat's benefits. "Within a few weeks after its launch, we saw that the variety of uses to which Landsat imagery could be put exceeded our expectations," said Dr. William Nordberg, Director of Applications at NASA's Goddard Space Flight Center in Greenbelt, Maryland.

Known originally as ERTS (Earth Resources Technology Satellite), Landsat proves that such unmanned spacecraft can also help geologists, hydrologists, and agriculturists, as well as planners, keep up with rapidly

*Inquiries about photographic reproductions of the mosaic or its regional parts, as distinct from the printed version distributed with this issue of NATIONAL GEOGRAPHIC, should be addressed to General Electric Photographic Engineering Laboratory, Herzel Place, Beltsville, Maryland 20705.

changing conditions on earth. According to Dr. Stanley C. Freiden, Landsat Project Scientist at Goddard, the data can serve not only the United States but also the social, cultural, and economic development of other nations. And uses continue to grow—for forestry, range management, water and marine resources, environment monitoring, land-use planning, and mapping.

In the United States, three stations—at Fairbanks, Alaska; Goldstone, California; and Greenbelt, Maryland—receive Landsat's stream of numbers. At Goddard the numbers are recorded onto film, and onto magnetic tape for use by conventional computers. These are shipped to the Department of the Interior's new Earth Resources Observation Systems (EROS) Data Center at Sioux Falls, South Dakota, and to other agencies. From EROS's library, anyone can buy a variety of film products and tapes for his own use.

Other Nations Request Tie-in

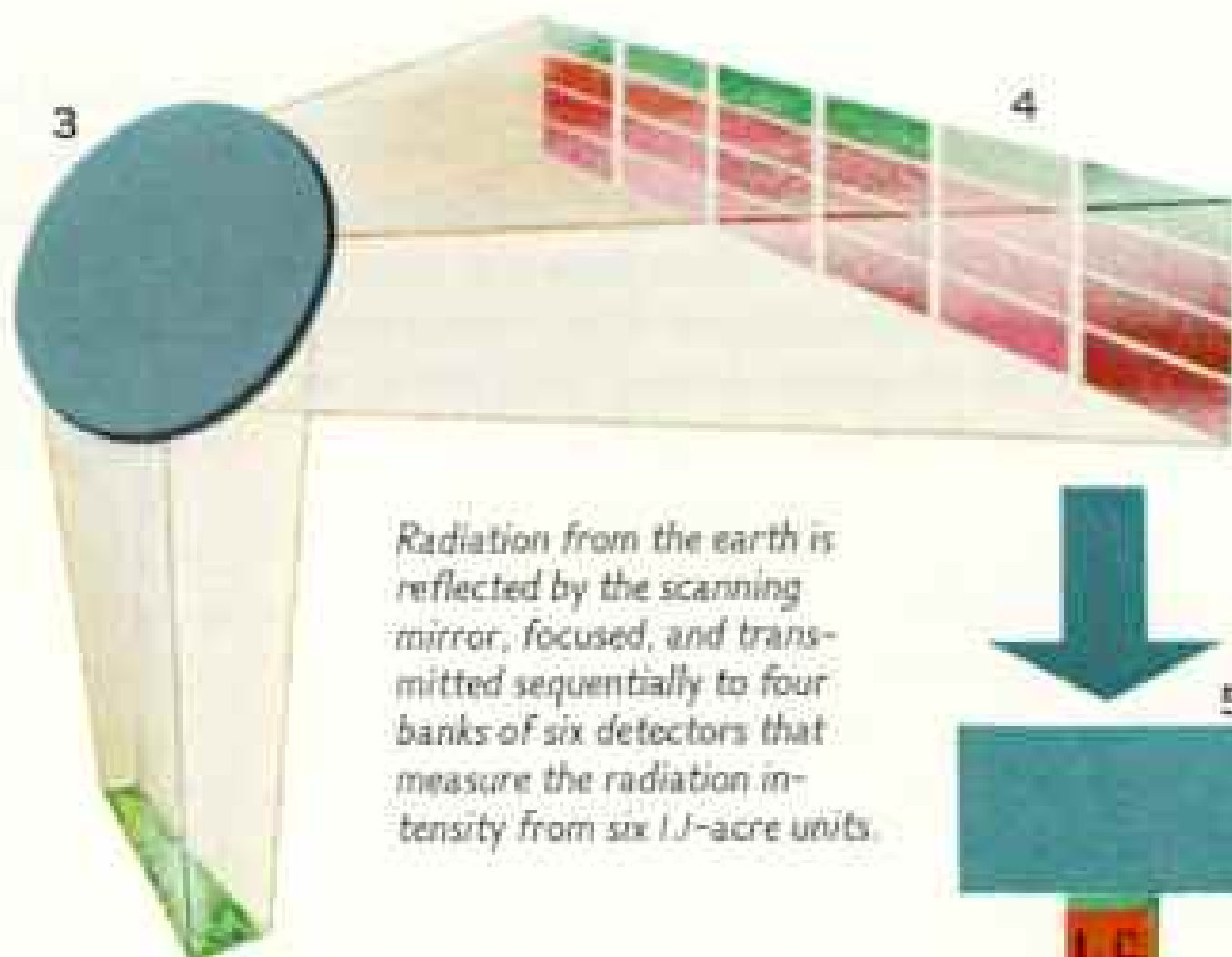
Elsewhere in the world, Canada, Brazil, and Italy receive and process Landsat imagery; new stations are planned or being built in Iran, Zaire, and Chile.

One week after the launch of Landsat 1, NASA geologist Dr. Paul Lowman made a new geological map of California's Coast Ranges near Monterey Bay. Landsat had shown him more than thirty previously unknown linear features—possible geological faults.

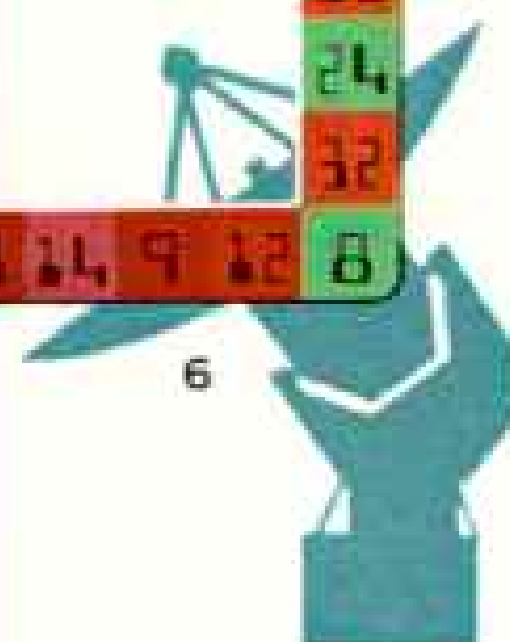
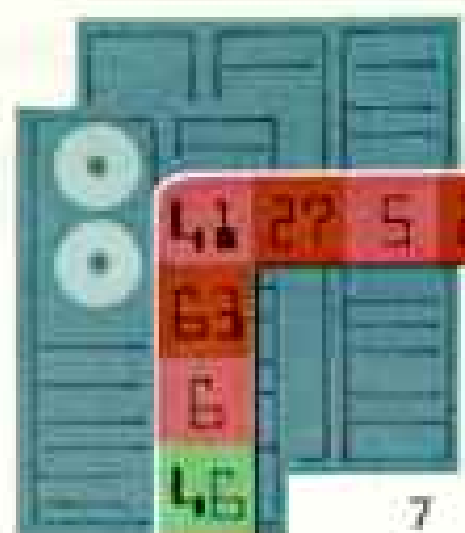
Geologists are intrigued by the patterns of such lines. Some indicate mineral, oil, and groundwater locations, and even earthquake zones. State officials in Arkansas had long been troubled by road-damaging landslides that geologists and engineers were unable to predict. Landsat images indicated fault systems that could be avoided.

Companies that explore for minerals and petroleum have been quick to seize on Landsat images as money- and timesaving tools; private industry accounts for 30 percent of EROS's present sales. A metals and chemicals company, NL Industries, was able to map several thousand square miles of geologically uncharted terrain in only a few months using Landsat imagery. Conventional methods would have taken more than two years.

From Landsat imagery agricultural experts can now identify several crops with high accuracy in fields as small as twenty

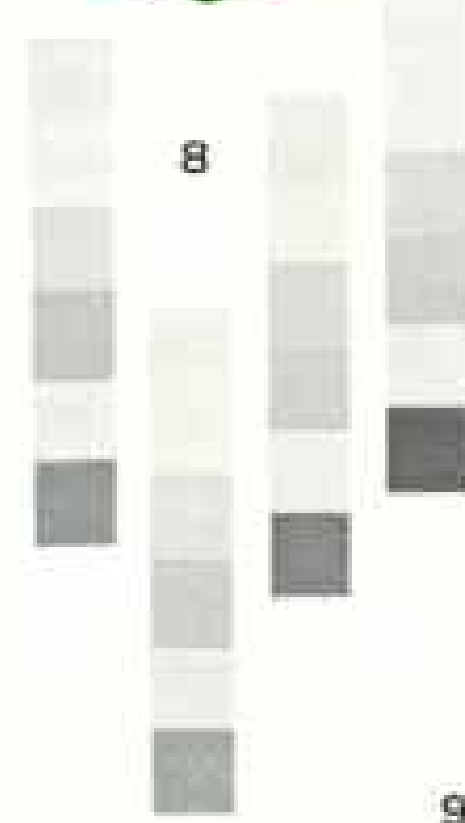


Radiation from the earth is reflected by the scanning mirror, focused, and transmitted sequentially to four banks of six detectors that measure the radiation intensity from six 1/4-acre units.



41 22 5 26 53 18 15 8 14 9 12 8

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54



**How our
"eye in the sky"
works**

acres. The extent of forest-fire damage in Yolo County, California, was accurately measured by Landsat for a tenth the cost of conventional aerial observation.

In Alaska the satellite records and monitors forest fires, and senses glaciers for signs of rapid movement that can dam up meltwaters. Should these dams suddenly break, devastating floods could result.

When disasters do occur, such as the Mississippi River flood of 1973, Landsat not only furnishes accurate images of their extent, but also gives clues for future flood protection.

Landsat revealed turbidity swirls full of silt in Lake Superior at a point where a city had built an eight-million-dollar freshwater-intake line. If Landsat imagery had been available during the planning stage, this expensive mistake could have been avoided.

Environmental Abuses Scrutinized

Man's use and misuse of the environment does not go unnoticed. The U. S. Army Corps of Engineers used Landsat data to pinpoint and measure water impoundments larger than ten acres. In Oregon the widespread extent of clear-cutting in heavily forested regions was not fully realized until Landsat 1 dramatically revealed its magnitude. The effects of strip-mining, too, are under the scrutiny of Landsat's watchful eyes.

Landsat has also indicated that air pollution may cause weather modification on a regional scale. Images showed that steel mills and power plants in Gary, Indiana, and Chicago generated clouds that drifted northeast with the winds, and dumped rain and snow on the eastern side of Lake Michigan.

Increasingly, Landsat imagery is being used to protect us from ourselves. Recently Florida land developers were convicted for selling "dry land" to unsuspecting buyers. Evidence from a satellite showed the land to be under water almost half of the year.

Before Landsat began its systematic sensing of the changing features of our land, broad-scale land-use monitoring was severely limited. Producing comparable maps by conventional means was costly and the time required was such that, when finally produced, they were out of date. Landsat helps to eliminate these restrictions.

While densely populated areas are more difficult to map, significant changes in urban-rural boundaries have been charted, as well as other urban land-cover patterns—to the intense interest, for example, of the U. S. Bureau of the Census.

Human Input Supplies "Ground Truth"

The quality of satellite images is being constantly refined by sophisticated computer techniques. Systems have also been developed that allow users to interact with computers and convert data to valuable, thematic information. By comparing "ground truth"—what is actually identified by fieldwork—with the satellite image of a small area, researchers can verify what the pixels in the image represent. The computer can then extrapolate those findings to much larger areas.

By this means useful maps can be produced quickly and accurately, offering selected information: types of terrain, the extent of vegetation, gypsy moth defoliation. Wildlife biologist John Craighead has used Landsat data to map grizzly bear habitat in Montana (page 148).

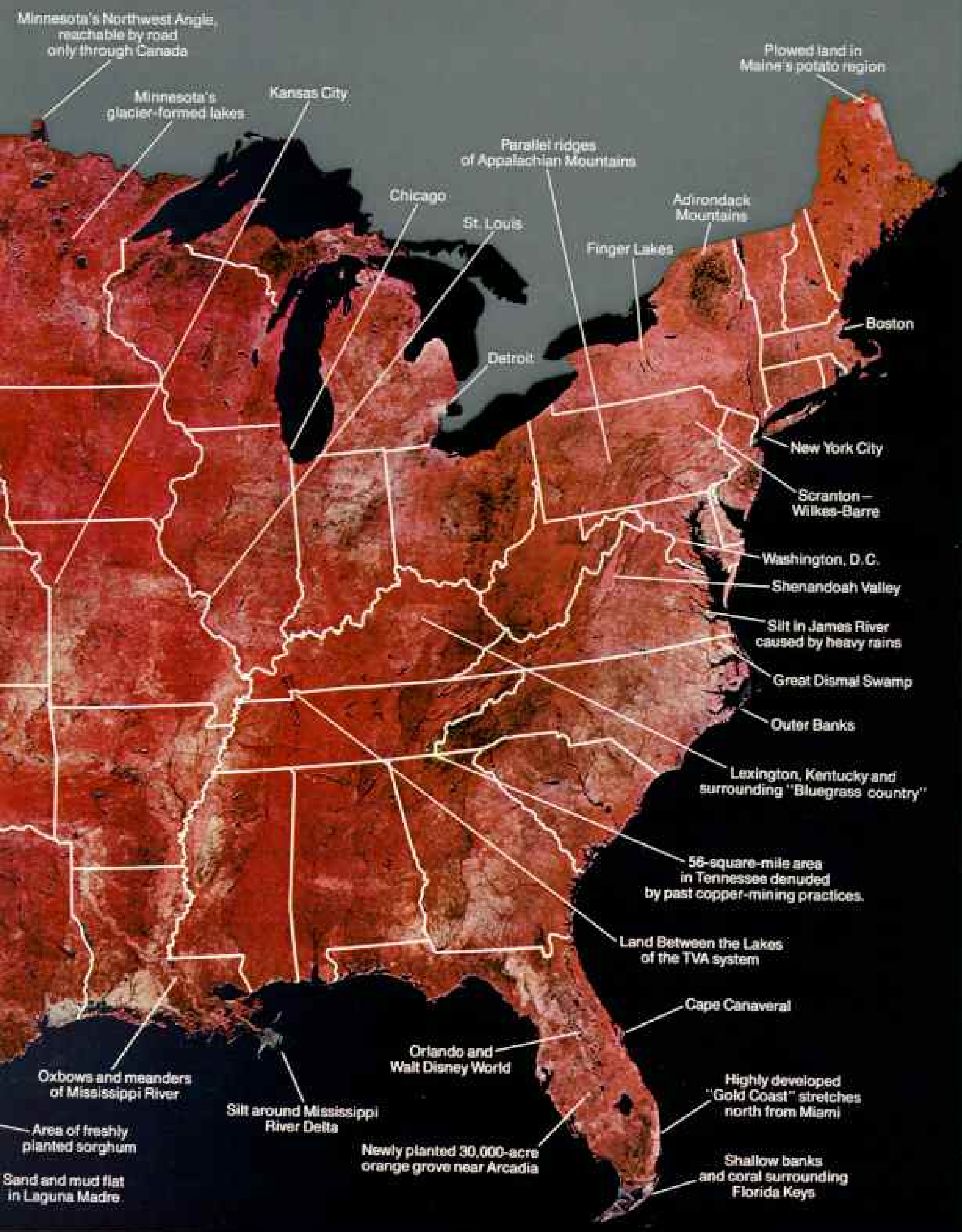
The U. S. Geological Survey is considering such thematic maps to chart land cover across the country. At its Land Information and Analysis office in Reston, Virginia, James R. Wray showed me two similar maps of the Washington, D. C., area. One of them, based on conventional aerial photography, classified units as small as ten acres and took a year to produce. The other, derived from Landsat imagery, classified pixels of 1.1

Monitoring our changing earth. Landsat surveys 13,225 square miles every 25 seconds. Here, passing 570 miles above Florida's Lake Okeechobee, the satellite records reflected light from a 115-mile-long swath of terrain (1). Inside the multispectral scanner (2) an oscillating mirror (3) channels the light through a telescope to detectors (4) sensitive to four different bands of the spectrum. After the detectors convert the light into electrical voltages, a digitizer (5) translates them into number values from zero to 63. This data is beamed to receiving stations (6), recorded on tape, and shipped to a central processing facility at Goddard Space Flight Center (7). Transformed into black-and-white transparencies of earth images (8), they are printed through filters onto color film to create the final Landsat scene (9).

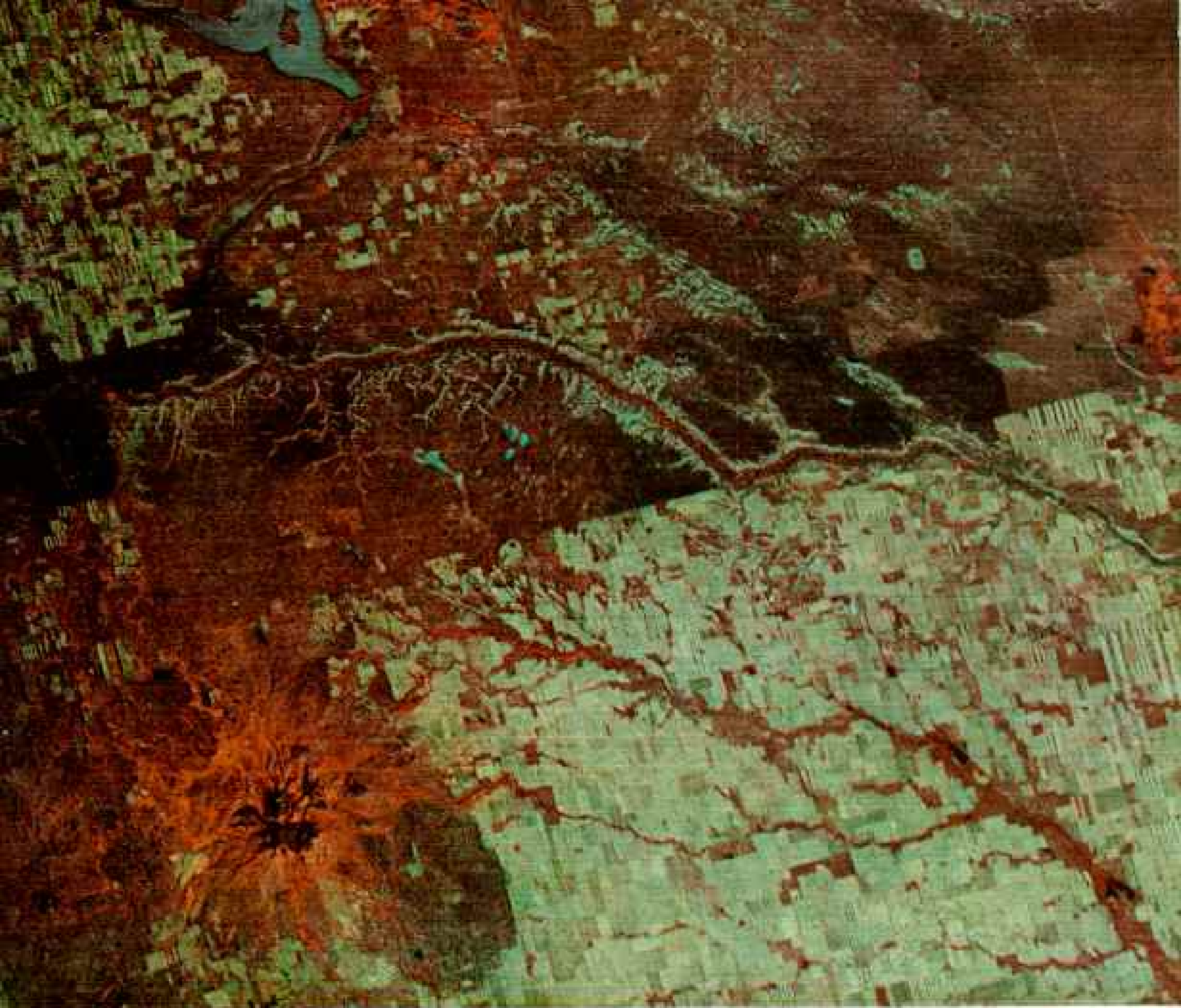
NATIONAL GEOGRAPHIC ARTIST ROBERT C. BAILEY



Color from technology's palette brightens the mosaic portrait of our land. Landsat images are normally rendered as shown here, in hues similar to those of color infrared photographs, in order to distinguish more detail. The map supplement distributed with this issue converts the portrait into colors closer to those the eye would see. Landsat's



high-altitude view eliminates most of the distortion usually found in low-level aerial photography and permits highly accurate matching along the seams of the mosaic. The political map on the supplement's opposite face, drawn to an identical projection, serves as a detailed guide for feature-by-feature comparison.



Montana's wheat-field quilt ends abruptly at the Canadian border where the ragged rip of the Milk River flows from the rangelands of Alberta. Such sweeping Landsat views of the

acres each and required three months to complete, including a mere eight minutes of specialized computer time.

Landsat's possibilities in resource management seem limited only by imagination and ingenuity. In a North Carolina test program it helps maintain an accurate inventory for 60,000 acres of a large tree farm. In western mountain states it monitors and measures snow cover and runoff for better water management.

Crop Forecasts for the World

With four billion mouths to feed, the world's farmers desperately need timely information. By combining figures on crop acreage computed from Landsat imagery with yield estimates derived from meteorological

data, we might accurately forecast harvests on a global scale.

Toward this goal, NASA, the Department of Agriculture, and the National Oceanic and Atmospheric Administration have created LACIE (Large Area Crop Inventory Experiment). The present study involves wheat—primarily in North America—but it will be extended to other areas. Studies for NASA estimate that if the accuracy and timeliness of worldwide wheat forecasts could be significantly improved, farmers and consumers would benefit by millions of dollars.

A principal investigator for NASA, Ralph Bernstein of IBM, has helped develop special all-digital processing and correction techniques to replace the electro-optical system now in use. The advantages of this new



NASA

earth find a burgeoning variety of uses: management of ranges and forests, monitoring of crops and the environment, and aiding in the discovery of new energy and mineral sources.

technology are greater accuracy and quality at reduced cost and processing time.

With Goddard, IBM is now building such an all-digital system for precise and rapid processing of satellite sensor data—a full Landsat scene in just two minutes rather than 35 or more. It will be operating by the time the third earth resources satellite is launched in September 1977.

Next Satellite Will "Read" Heat

Landsat 3 will be able to see more than the earlier satellites. A thermal infrared sensor will augment the existing bands of the multi-spectral scanner, and will monitor heat islands such as industry, nuclear power plants, and cities.

What does the future portend? Far more

than simply portraits of countries from space. Judging from Landsat's performance, we can look forward to a network of information services from the skies. A noted geologist, Dr. Michel T. Halbouty of Houston, Texas, may have given us only a modest appraisal of Landsat's ultimate value when he called it "one of the most important national initiatives ever conceived and implemented in our 200 years of existence."

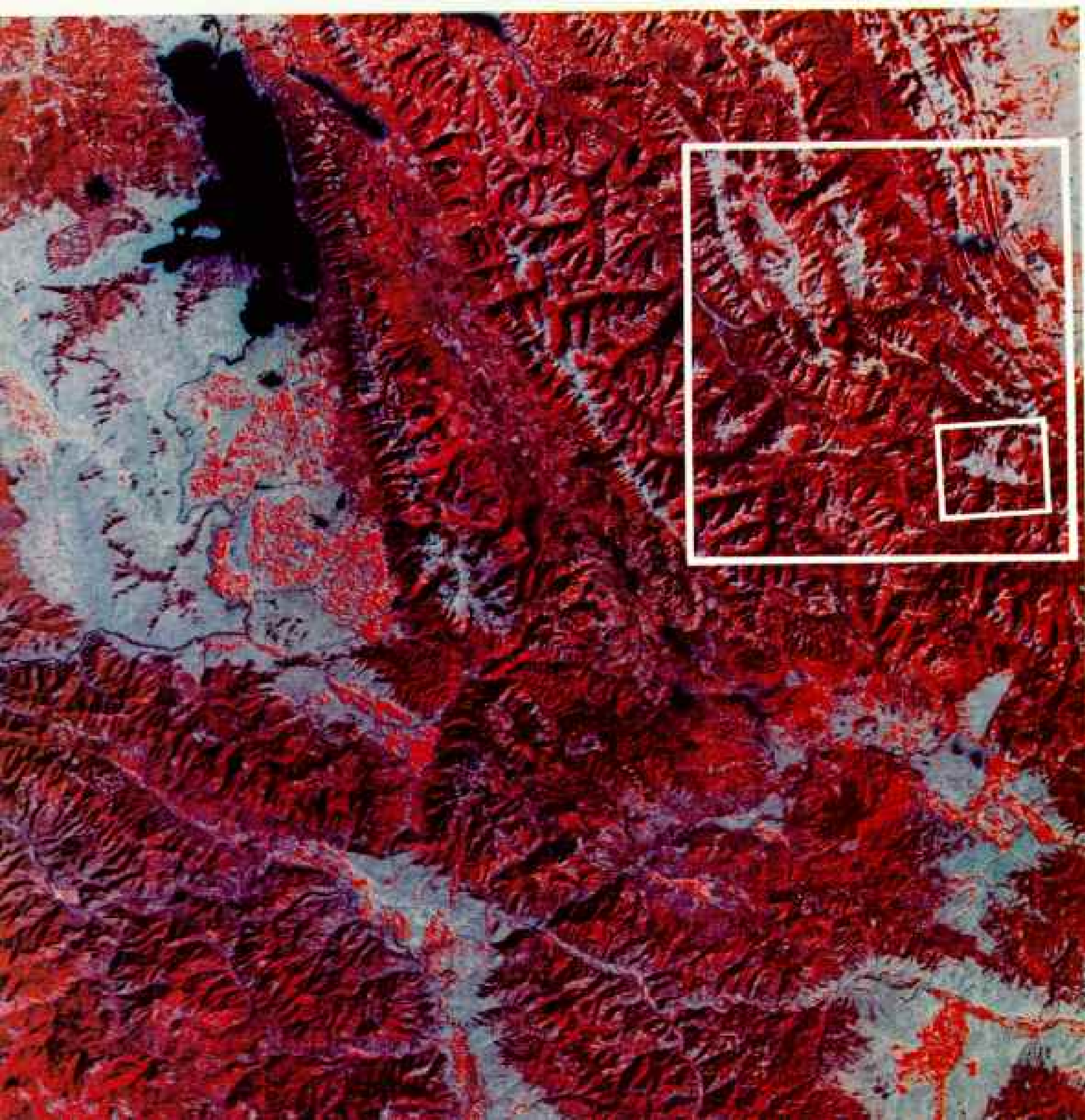
For the past four and a half billion years our ever-changing planet has been absorbing and reflecting the sun's energy. Now, for the first time since creation, a portion of the earth's surface radiance is being methodically monitored and measured to help us understand our home—and show us the difference between wise use and wanton abuse. □

Studying Grizzly Habitat by Satellite

By JOHN CRAIGHEAD, Ph.D.



Where grizzlies roam:
In Montana's Scapegoat
Wilderness, the author, left,
Steve Ford, son of the
President, and Jay Sumner
examine a satellite-computer
map of their study area.





FARER, CRANDALL, WYNNON (LEFT), AND NARA

ONCE THE GRIZZLY BEAR roamed the American West by the tens of thousands. Today, probably fewer than a thousand are left in the contiguous 48 states, almost all in ten million mountainous acres of Idaho, Wyoming, and Montana. Those that remain seem hard pressed.

My brother Frank and I, aided by University of Montana colleagues and students, have spent 18 years studying the grizzly in its wilderness domain. Partially as a result of our work, the Endangered Species Act of 1973 was amended to include *Ursus horribilis* as a threatened animal.

From our research we knew something about the biology of the grizzly—its food preferences, social behavior, spatial needs, the delicate balance between its birth and death rates. But we had very little scientific knowledge of its habitat—how it could be defined and described, how it is being modified. By understanding the grizzly's habitat in a specific area of wilderness, could we not more accurately estimate the population? This, I had hoped, would enable responsible agencies to make better decisions concerning grizzly bear management.

I knew it would be hard to find the answers using the now-conventional field research methods of color marking and radiotelemetry that we had pioneered in Yellowstone National Park. The problems of recording deaths and of censusing the bears over their immense

ranges of rugged terrain were formidable.

In 1973 my colleagues Jay Sumner and Joel Varney and I discussed one possible solution with Donald Comstock of the United States Forest Service. Perhaps we could harness the amazing vision of the Landsat satellite and its ability to distinguish types of ground cover.

The key to this process is the intensity of light reflected by various types of terrain—forest, meadow, rock. Each tends to have a unique reflectance value, and a computer system can be “trained” to identify all vegetation with similar values, or “signatures,” on a satellite image.

To ensure that those identifications are accurate, however, they must be checked against a map of the same area where the vegetation is known by fieldwork—the “ground truth” input.

Within the 13,225-square-mile Landsat image of western Montana (left), which is projected on a satellite map of the entire state (above, left), I selected a study area of 81 square miles in the Scapegoat Wilderness (smallest box). Once this small area was ground-truthed, vegetation signatures could be used to map it accurately by computer, and the same system then applied to a much larger area (larger box). Using this technique, we felt we could map out grizzly habitat across millions of acres of barely accessible wilderness.



NATURALIST JOHN MUIR once said of the grizzly that "to him almost everything is food except granite." In fact, the bears are rather selective eaters, but they have a varied menu. Grizzlies, like the two mothers and their cubs on a foraging trip in Yellowstone National Park (above), are omnivorous; plants comprise between 70 and 80 percent of their diet. Our research has revealed the basic components of grizzly bear habitat. His living space must contain

huckleberries, whitebark pine nuts (right), small rodents, and big game.

These foods tend to fluctuate in abundance from year to year, however. If both pine nuts and berries are scarce during one season, the grizzly is lean and hungry and must rely on grasses, sedges, and plant tubers to carry him through. He often dines on the succulent leaves and starchy roots of the bigroot spring beauty (far right, upper) or the bulbs of *Melica spectabilis* (far right, lower), a mountain grass.

Animals on his menu include an occasional elk, such small mammals as the rabbit-related pika (left), the ground squirrel, and the pocket gopher, plus carrion and fish.

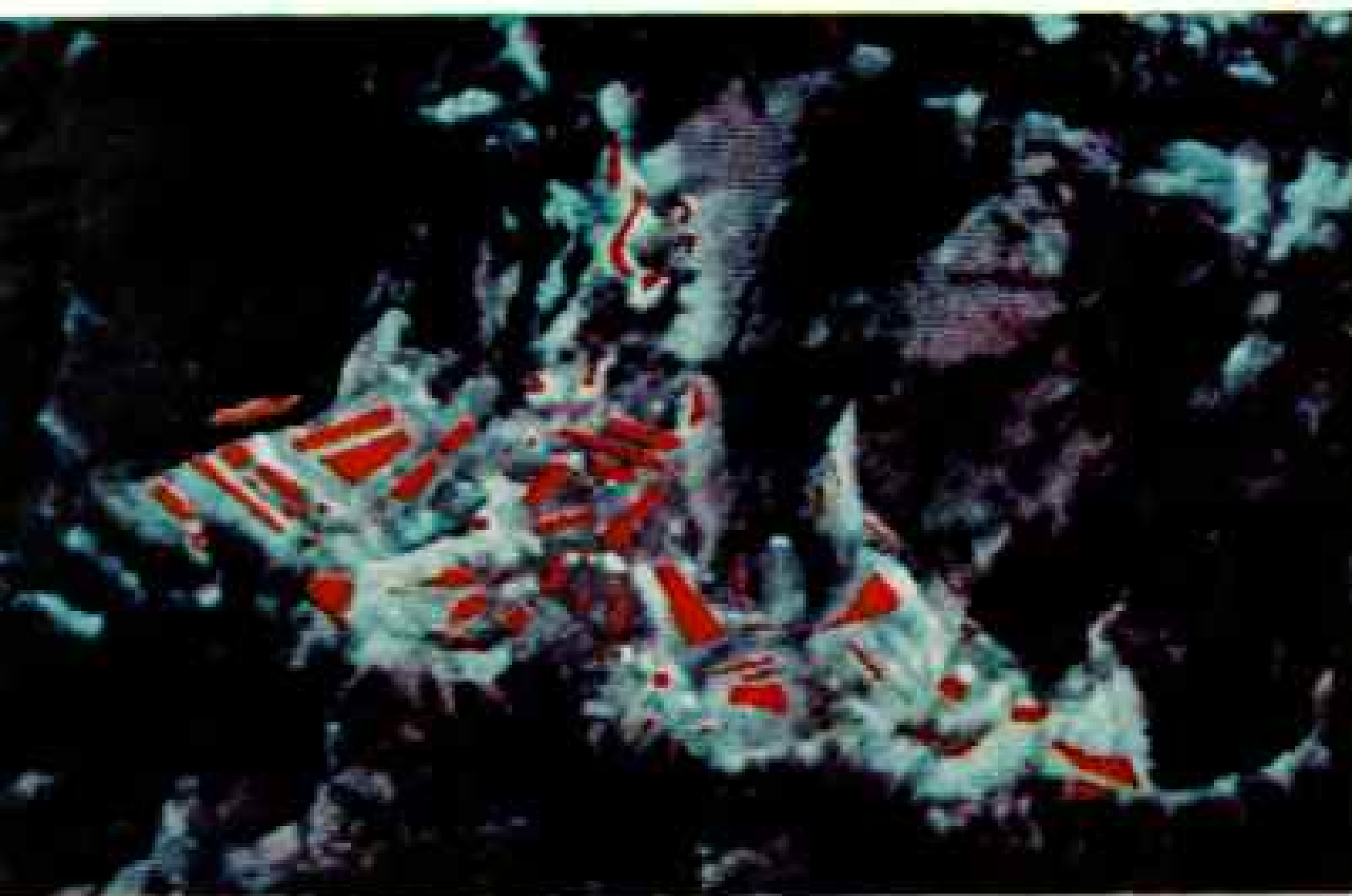
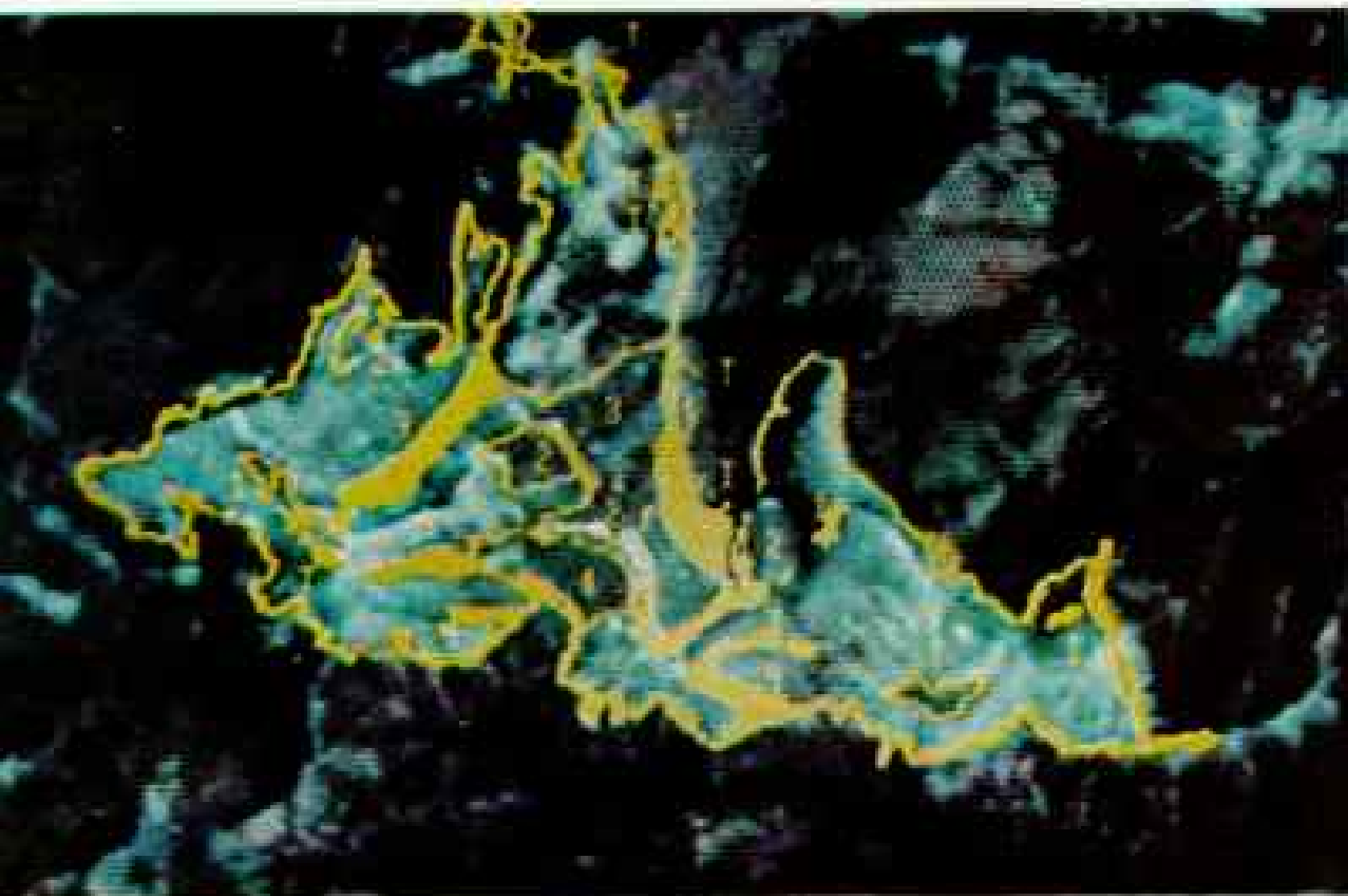
With this type of knowledge of the grizzly's eating habits, and aided by the National Geographic Society, the National Aeronautics and Space Administration, the U. S. Fish and Wildlife Service, and the U. S. Forest Service, we set out to map the grizzly's larder.





JOHN CRAGGED (40000) AND ERIC CRAIGED (40000) HAYMAN





AFTER TWO SUMMERS of rigorous fieldwork sampling vegetation (left), we were ready to apply our knowledge to Landsat imagery.

First we displayed a satellite image of the study area on the television screen of a General Electric Image 100 computer system. This image is composed of over 47,000 elements called pixels, each of which is a record of the reflected light intensity from 1.1 acres of terrain. The color-coded overlays on the image show our method of constructing a vegetation map.

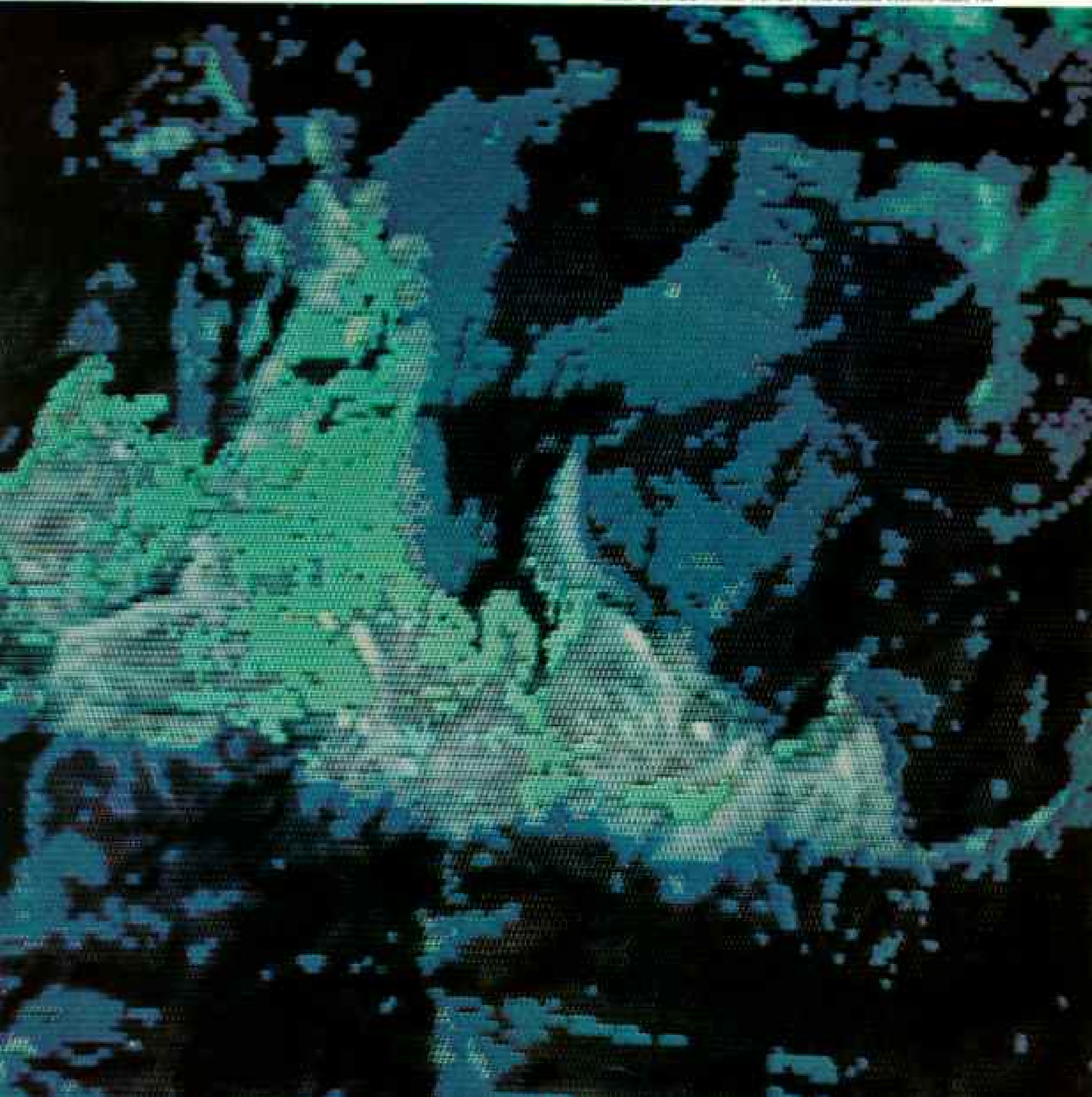
We begin by superimposing in yellow the

areas that define the alpine meadow complex we had mapped and identified on the ground (middle, left). This provides a base for locating our sample vegetation plots. Then we superimpose these plots in red (lower left). Those that represent the alpine meadow complex show the computer precisely where to "read."

Once the computer is trained to recognize alpine meadow complex, we direct it to analyze the image for all other areas of alpine meadow, and to display them in turquoise on the screen (below). Similarly, subalpine parkland is mapped in darker blue.

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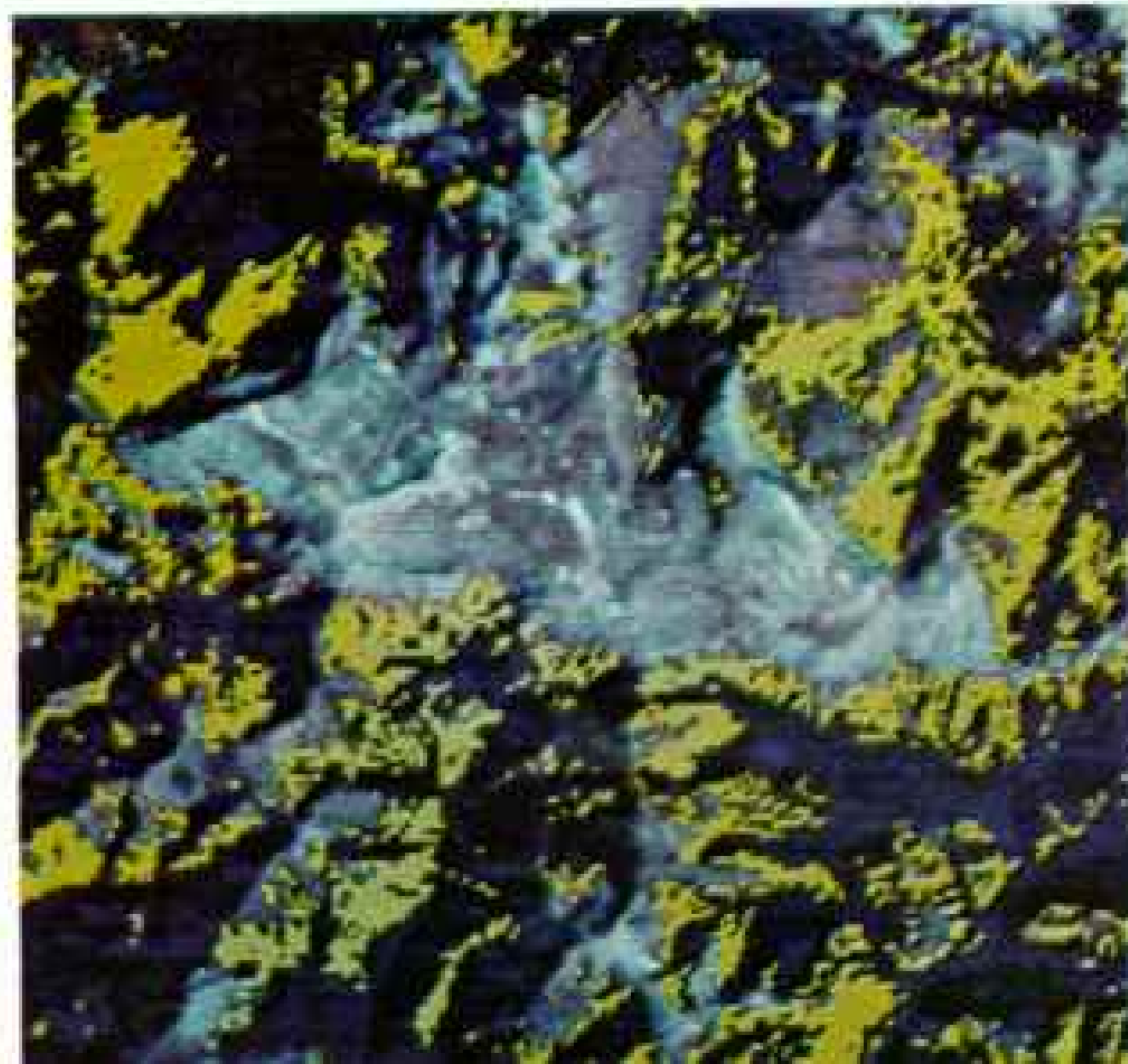
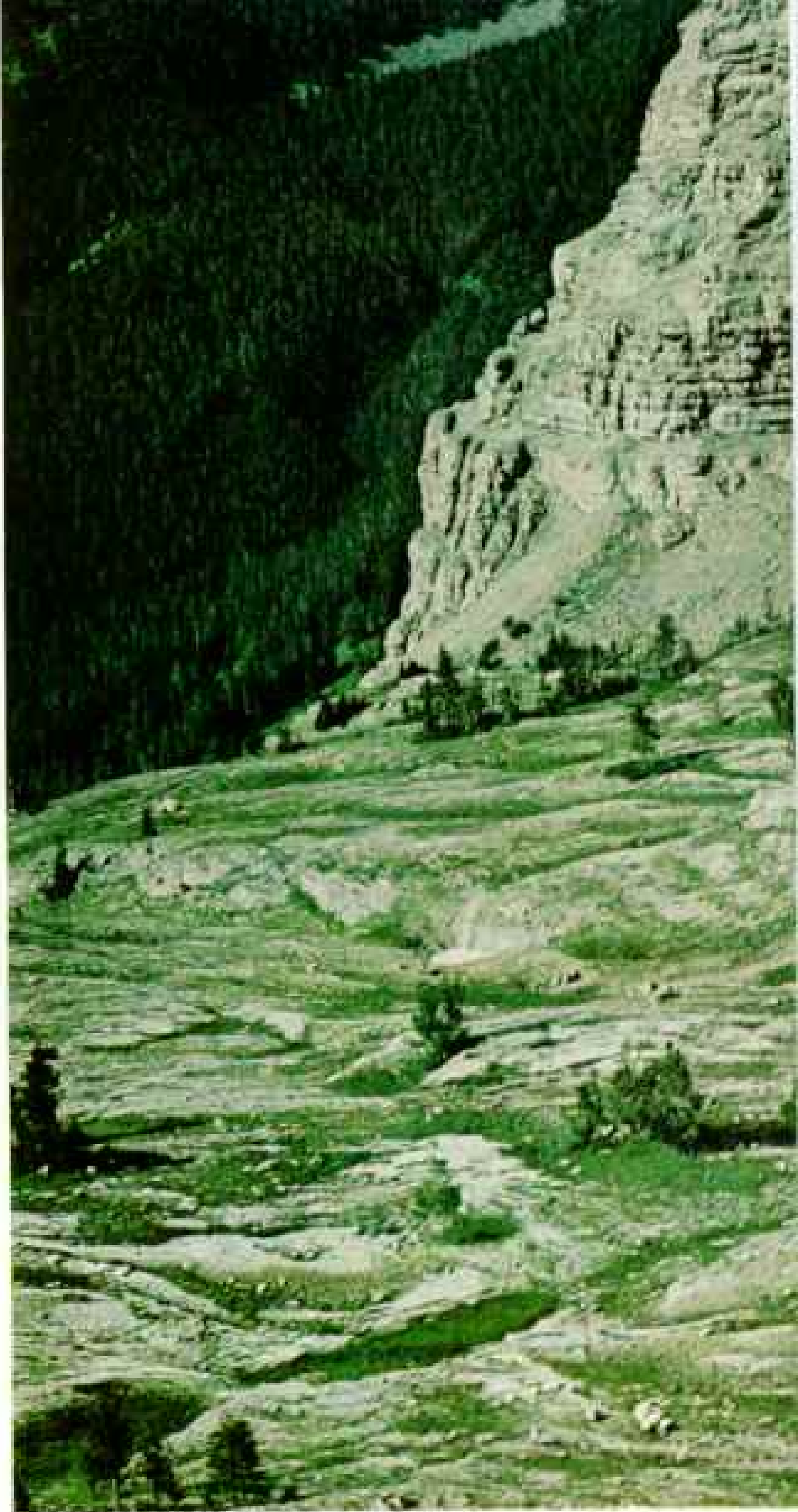
BARBARA CRAIGHEAD HAYNAM (TOP LEFT), AND GENERAL ELECTRIC IMAGE 100



THE RUGGED LAND favored by the grizzly is a high-altitude alpine wilderness untouched by development. Like most mammals, grizzlies have home ranges—tracts where an individual animal or a family of bears can meet its biological requirements for foraging, socializing, breeding, denning, and finding seclusion from man, its only major enemy. A home range may vary from 50 to 1,000 square miles, and we have learned that adult males require more space than adult females.

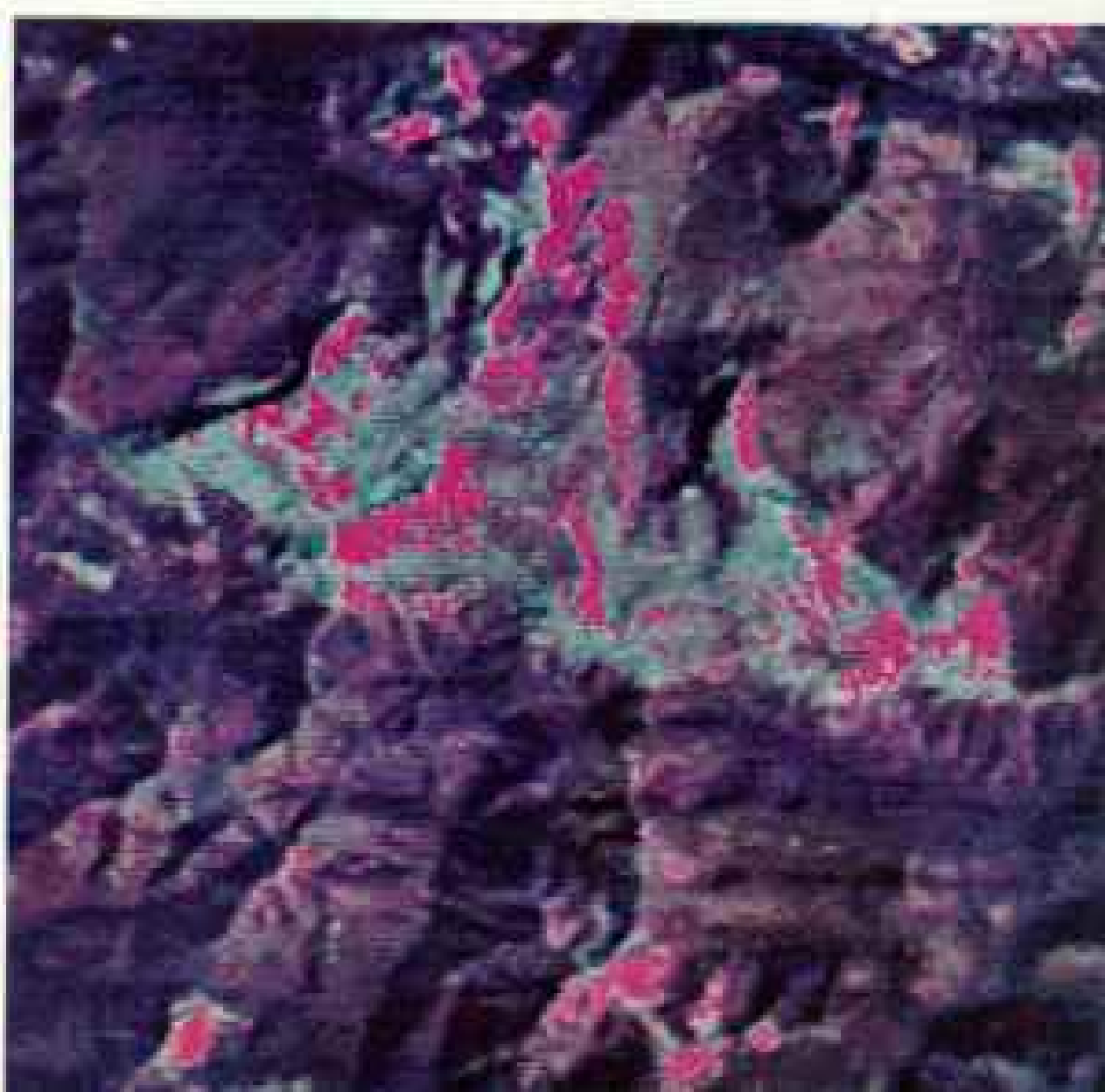
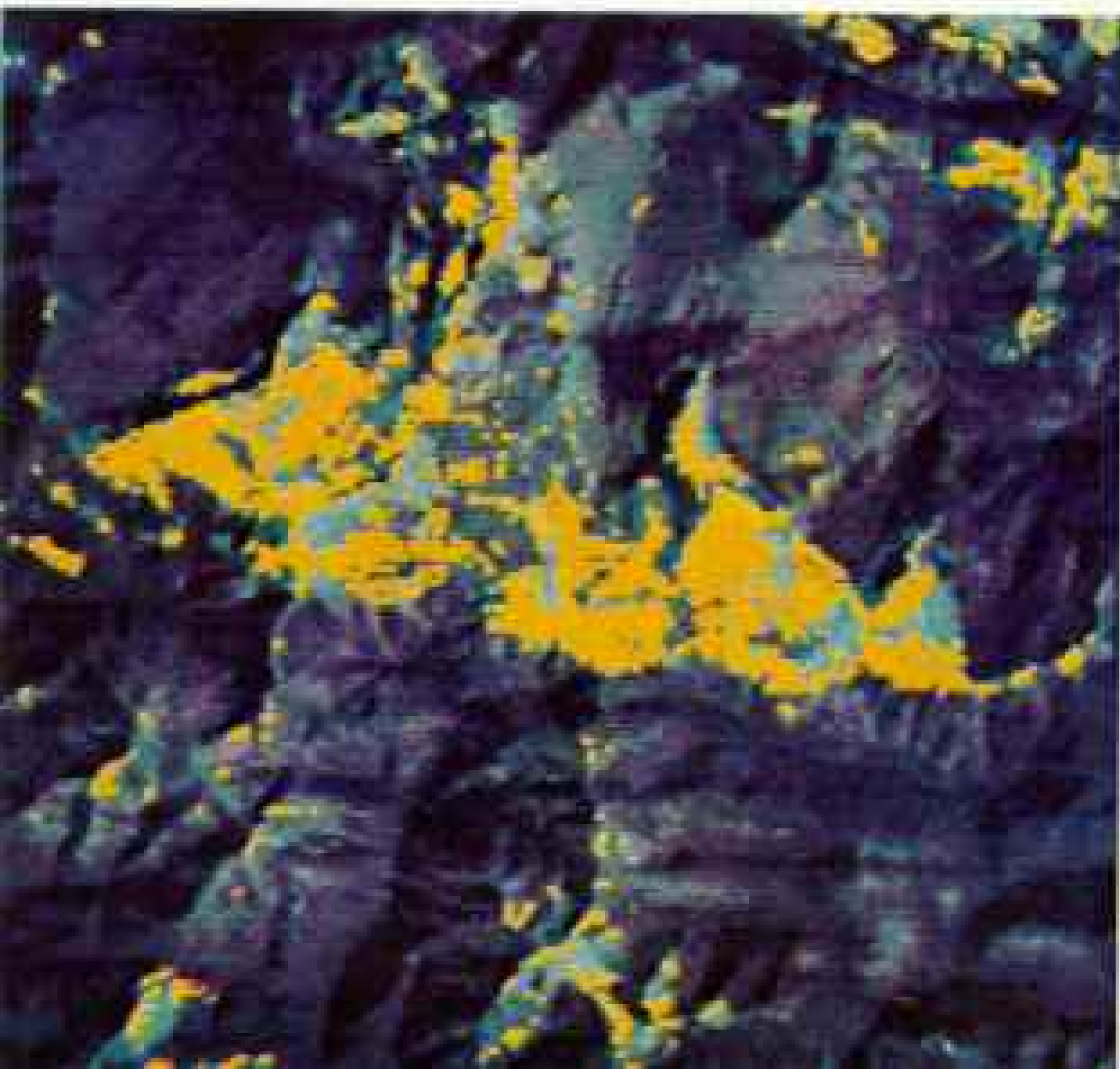
A glacier-dug basin, or cirque (right), only a small section of our study area in the Scapegoat Wilderness, offers a variety of grizzly forage in three major categories. Using the process outlined on the previous pages, we can train the computer to display these vegetation types in colors on the satellite image (below, right).

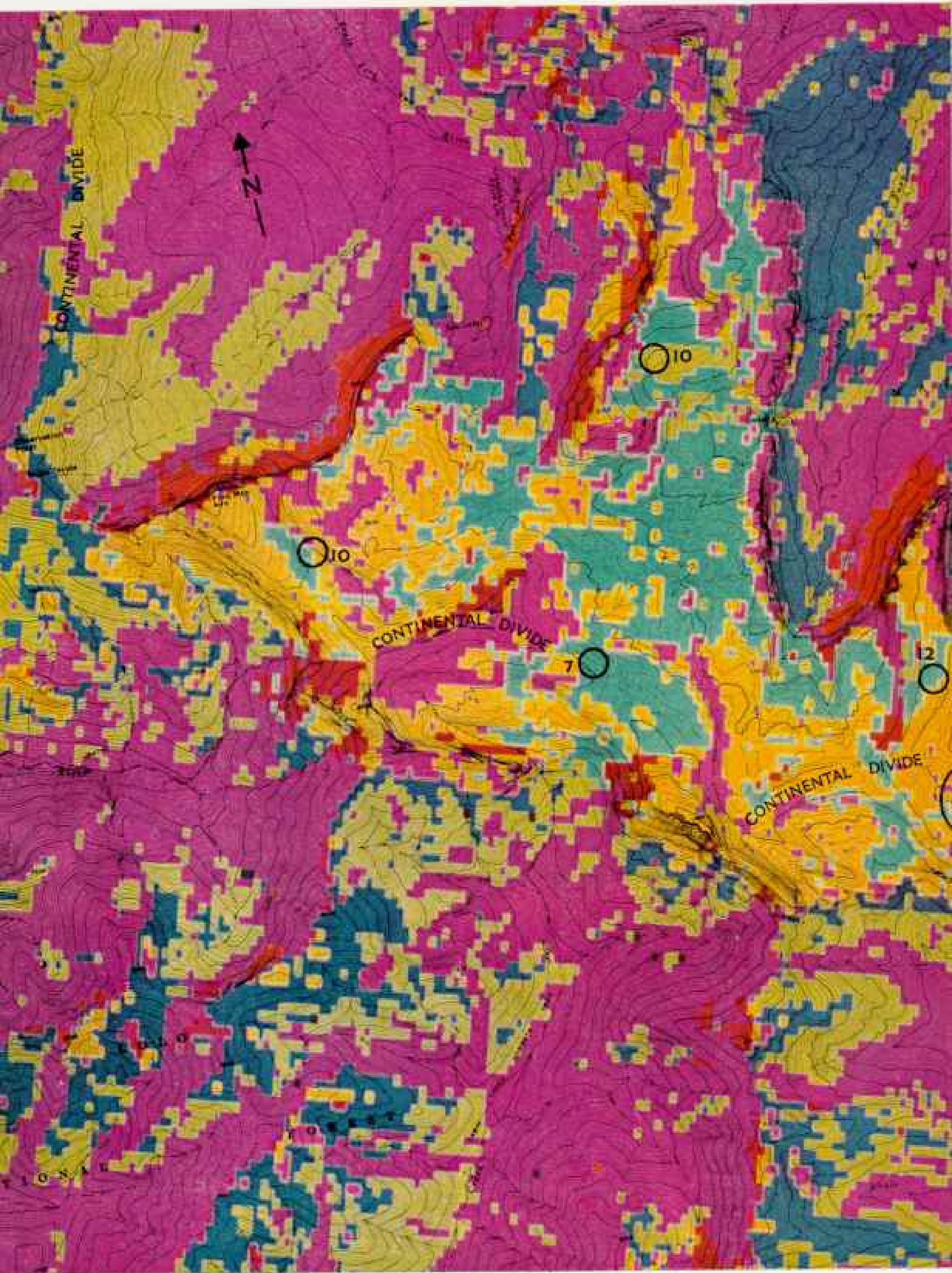
Dense whitebark pine forest, shown in olive (left), covers the slopes below the cirque; vegetated rock, in orange (middle), coats the basin floor; and "bare" rock, in magenta (right), hosting only sparse plant growth, looms above a talus slope of rock debris.

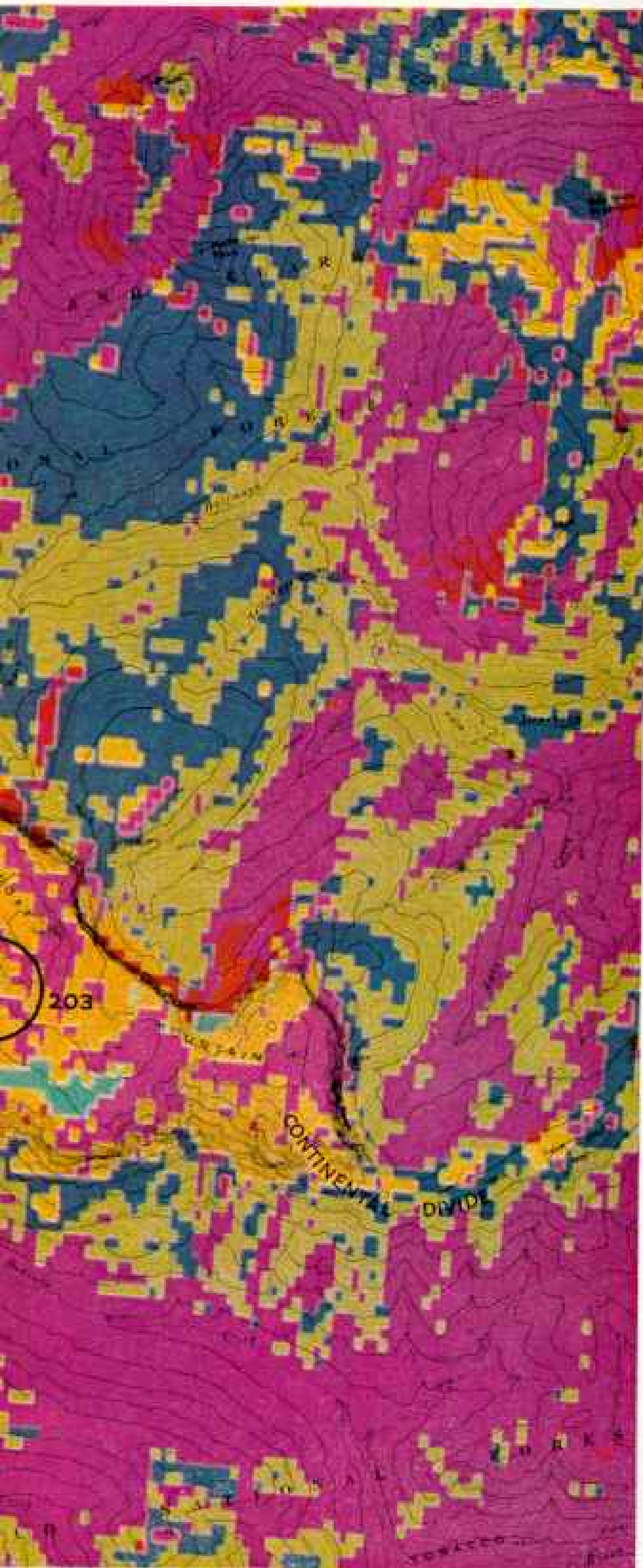




KAREN CONYBEAR HEYMAN (LAPYR) AND GENERAL ELECTRIC (MALL 100)







CONTOUR MAP BY U.S. GEOLOGICAL SURVEY

THE PATTERNS of the grizzly habitat finally unfold on the completed map of our study area (left). The color coding identifies eight specific rock and vegetation complexes that we classified (key below). By adding contour lines, we can visualize the features that give us a three-dimensional look at the land.

But the testing was not yet complete. We rigorously challenged the accuracy of this map by comparing the computer classifications against 264 ten-acre ground sites where we knew the vegetation, and we found that this habitat map was 88 percent accurate.

But how do animals use this land? The map reveals circled "activity centers" where grizzlies congregate to feed. The relative use of these centers is expressed by the number of direct and indirect observations as plotted on the map. We find, for example, from actual sightings and secondary evidence such as tracks, feces, and diggings, that a favorite foraging ground for the grizzly is the vegetated rock complex at about 8,800 feet.

From direct observations of the grizzly, and from analyses of its droppings, we know which foods it prefers. Now we can also determine, over a broad area, where it can find them.

- ACTIVITY CENTER
- ROCK AND VEGETATION COMPLEXES
- VEGETATED ROCK
- SANDSTONE AND ARGILLITE
- LARGELY LIMESTONE
- TALUS SLOPE
- SUBALPINE PARKLAND
- WHITEBARK PINE FOREST
- ALPINE MEADOW
- CONIFEROUS FOREST

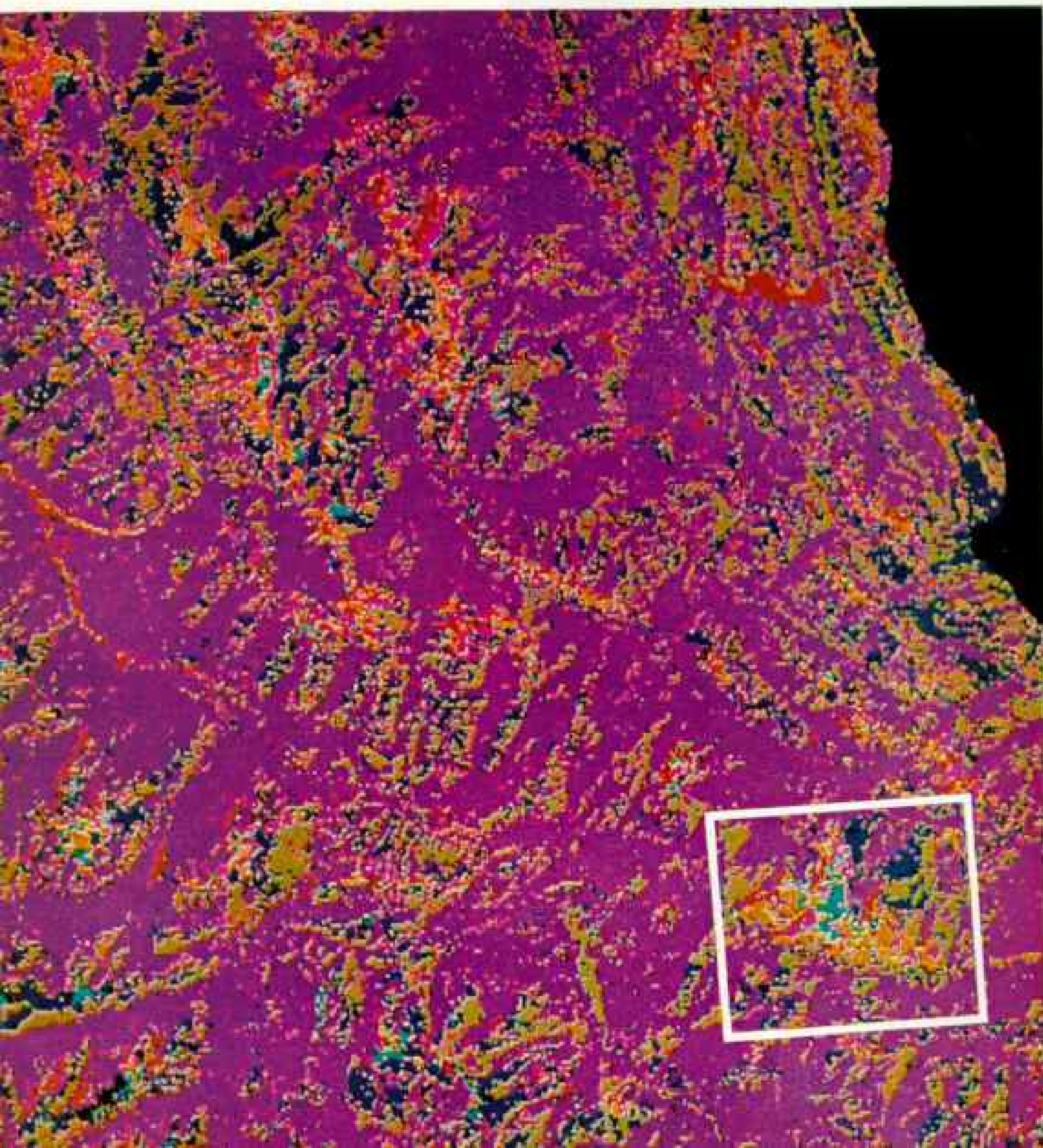


NATIONAL GEOGRAPHIC PHOTOGRAPHER BERNIE LAVIE AND GENERAL ELECTRIC (IMAGE TOP

THE PAYOFF for months of fieldwork comes in a matter of hours as systems analyst Ned Buchman and I put technology to its final test (above). Based on signatures measured in our 81-square-mile study area (small box,

below), we now electronically expand the study-area map to encompass an area 17 times as large. Next summer we will return to the field to verify the accuracy of other sites within this approximately 1,400 square miles of surrounding grizzly country.

Space technology can give greater understanding of grizzly bear numbers and habitat requirements. Now we need the wisdom to apply space science, courage to act in the interests of endangered species, and foresight to properly manage a rapidly changing national landscape where even wilderness may not be inviolate. □



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If you drive in the city, you need the City Car: the Honda Civic.

There are over 600 Honda Civic dealers all over the country. Test own a Honda Civic soon. It's an unforgettable experience.

CVCC, Civic and Hondamatic are Honda trademarks.
© 1976 American Honda Motor Co., Inc.

EPA mileage estimates. Avg. 4- & 5-speed hatchback, sedan models. The actual mileage you get will vary depending on the type of driving you do, your driving habits, your car's condition and optional equipment. Combined mileage based on Federal Highway Administration estimates: 55% city driving, 45% highway driving conditions.

Manufacturer's suggested retail price plus tax, license, transportation charges, optional equipment, and dealer's preparation charges. Shown with optional mag style wheels and 13" steel-belted radial tires \$388.40.

Civic CVCC 1488cc	Price ¹	EPA Mileage Estimates ⁹		
		Hwy.	City	Combined Hwy. & City
Sedan (4-Speed)	\$2979	42	32	36
Hatchback (4-Speed)	\$3189	42	32	36
	(Hondamatic)	\$3349	33	25
Wagon (4-Speed)	\$3419	37	26	30
	(Hondamatic)	\$3579	32	24
5-Speed Hatchback (All states except Calif.)	\$3469	47	35	40
5-Speed Hatchback (Calif. Model)	\$3469	44	31	36
Avg. Sedan Hatchback (4- & 5-Spd.)		43	32	36
Civic 1237cc (Not avail. in Calif.)				
Sedan (4-Speed)	\$2729	41	28	32
Hatchback (4-Speed)	\$2939	41	26	32
	(Hondamatic)	\$3099	30	24

HONDA CIVIC
What the world is coming to.



A little bigger car from Honda.

The Accord.

'VALUE' – THAT POOR, OVERWORKED, EXHAUSTED, CLAIM HAS
44 mpg hwy/31 city* (EPA estimates), CVCC† engine, 5-speed transmission,



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*Your actual mileage will vary depending on the type of driving you do, your driving habits, your car's condition and optional equipment.

†Manufacturer's suggested retail price plus tax, license, transportation charges, optional equipment not shown, and dealer's preparation charges.

FOUND A REASON TO GO ON LIVING. THE NEW HONDA ACCORD.
luxury interior and more standard features than any car at its price. \$3995.†



HONDA ACCORD CVCC

“Mining makes a mess of the countryside.”

Different views. Polarized. Each seems true, yet in conflict.

Yes, mining disturbs the land. Surface mines overturn vegetation, destroy wild life shelter, disrupt farming, sometimes divert and contaminate streams. Deep mining leaves other scars: waste piles, abandoned shafts. Concerned people fear that mineral mining could destroy the beauty of our land.

Other thoughtful people point to the essentiality of minerals. We must have them for transportation, communications, for food production, houses. And we can only mine these minerals where they are found. We could, it's true, import more of our minerals. But this just moves the problem into someone else's backyard. And ignores the economics of developing our own natural wealth.

What can we do? We must have minerals. So we must have mines. But we must also protect the environment.

We can't mine everywhere. But we should, as a people, support land use decisions that realistically balance economic, social and environmental needs. Decisions that seek greater U.S. mineral self-sufficiency by opening all our lands to exploration and possible development. And we must be willing to pay the price of restoring them to other useful purposes when mining is finished.

With intelligent planning we can have our countryside *and* our minerals.

Raw materials are vital to the production of Caterpillar machines and vice versa. Our machines mine the land and help reclaim it. We believe both mining and reclamation are essential.

**There are no simple solutions.
Only intelligent choices.**



CATERPILLAR

Caterpillar, Cat and  are trademarks of Caterpillar Tractor Co.

“We have to mine minerals where we find them.”





BOTH BY NAPOLEON A. CHAGNON

Involvement brings rewards – and hazards

ADORNED WITH TRIBAL FINERY, anthropologist Napoleon A. Chagnon (above left) prepares to take part in a ritual of the warlike Yanomamo Indians of remote Venezuelan forest country. Reporting in next month's NATIONAL GEOGRAPHIC, Dr. Chagnon tells of his 12-year study, during which he parted the curtain of mystery hiding a people who still live—and die—by the bow and arrow.

Throughout the study Dr. Chagnon had to remain the objective scientist while he also became friend and counselor to an alert, curious people (above right). Such involvement, he

learned, led to knowledge that could be acquired no other way, but it also led to pressures that he join one or another faction.

"Objectivity became increasingly difficult for me the longer I lived with the Yanomamo," says Dr. Chagnon, a U. S. anthropologist. One village even marked him for death, because of alleged sorcery and his friendship with the village's enemies.

Share such scientific inquiries into the life-and-death worlds of little-known cultures. Nominate your friends for membership on the form below.

18-MONTH NATIONAL GEOGRAPHIC SOCIETY MEMBERSHIP

JULY 1976 THROUGH DECEMBER 1977

EIGHTEEN-MONTH DUES in the United States and throughout the world are \$12.75 U. S. funds, which is 1½ times the annual fee. To compensate for additional postage and handling for mailing the magazine outside the U.S.A. and its outlying areas, please remit for Canada \$15.70 in Canadian or U. S. funds; for the British Isles, Australia, and New Zealand \$19.20; for all other countries \$18.55 by U. S. bank draft or international money order. Eighty percent of dues is designated for subscription to the magazine. Upon completion of the initial 18-month term, memberships are renewable annually on a calendar-year basis.

LIFE MEMBERSHIP is available to persons 10 years of age or older. The fee for U. S. (including its outlying areas) and Canada is \$200 U. S. or Canadian funds; for all other countries \$250 by U. S. bank draft or international money order.

Mail to: The Secretary
National Geographic Society
Post Office Box 2885
Washington, D. C. 20013

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I WISH TO JOIN the NATIONAL GEOGRAPHIC SOCIETY and enclose my dues \$ _____

(FILL IN NAME AT LEFT.)

(GIFT MEMBERSHIP) I nominate and enclose \$ _____ for dues of the person named at left.

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I NOMINATE for Society membership the person named at left. (Use separate sheet for additional nominations.)

NEW MEMBER PRINT NAME OF AN INDIVIDUAL ONLY (MR., MRS., MISS, ME)

STREET

CITY, STATE, ZIP CODE

MY NAME PLEASE PRINT (MR., MRS., MISS, ME)

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NEWS FLASH



DATSUN'S NEW FRONT WHEEL DRIVE F-10.

HATCHBACK AND SPORTWAGON. Introducing the all-new F-10. Two bolts of engineering lightning that bring you the best of all small car worlds.

FRONT WHEEL DRIVE AND TRANSVERSE-MOUNTED ENGINE. Advanced engineering starts with corner-hugging front wheel drive. And a space-saving, sideways-mounted engine.

5-SPEED PERFORMANCE. Hatchback comes with a racy 5-speed performance gearbox. Sportwagon sports a smooth-shifting 4-speed.

FULLY INDEPENDENT SUSPENSION. Helps smooth bumps at all four wheels (Hatchback only).

HANDY HATCH AND OTHER STANDARDS. Hatchback has AM/FM

radio, tach, reclining front buckets, fold-down rear seat, radial tires and more.

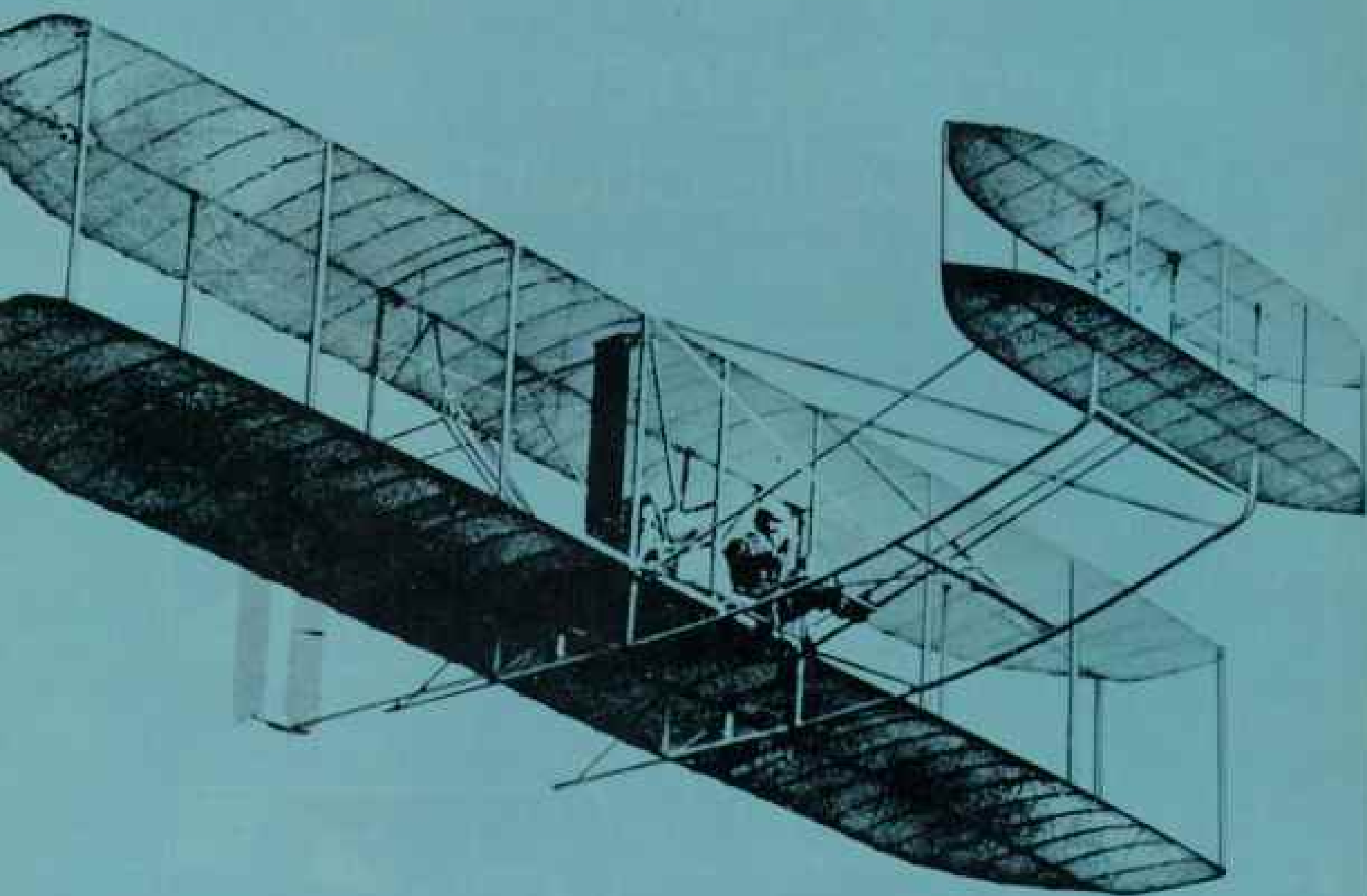
GREAT GAS MILEAGE, TOO. Both the 5-speed Hatchback and 4-speed Sportwagon got 41 MPG Highway, 29 City. (EPA mileage estimates. Actual MPG may vary depending on the condition of your car and how you drive.)

FLAT-LOADING WAGON. Ceiling-to-floor rear door lifts up for easy loading. Back seat folds down for extra large loads. Lots more to like, and it's Datsun's lowest-priced wagon!

See these fun-loving front wheelers now. At your Datsun Dealer, of course.

AMERICA'S #1 SELLING IMPORT





To honor two centuries of American leadership in the conquest of the air and the exploration of space, the National Space Institute proudly announces...



The Official Air and Space Ingot Collection

— in Solid Sterling Silver



America's first aerial voyage, 1793.



Wright Brothers flight, 1903.



Eddie Rickenbacker top U.S. ace, 1918.



World's first liquid-fueled rocket, 1926.



B-24 Liberator, 1941.



Bell X-1 breaks sound barrier, 1947.



Skylab space laboratory, 1973.



Viking mission to Mars, 1976.

A magnificent collection of 100 commemorative Proof ingots portraying the greatest events—and honoring the greatest heroes—of America's conquest of the air and exploration of space.

ON JULY 4, 1976, VIKING LANDER I is scheduled to land on the planet Mars. From there, its broadcasts to earth may provide the answer to one of man's most intriguing questions: does life exist on Mars?

How fitting it is that this great leap forward in space should be an *American* venture! Because for two centuries—ever since President George Washington officially endorsed America's first manned balloon flight—our country has been a world leader in the conquest of the air and the exploration of space.

To appropriately commemorate these 200 years of American leadership—and to honor the intrepid men and women who made it possible—the National Space Institute will issue *The Official Air and Space Ingot Collection*.

A history of America in air and space

The collection will consist of 100 commemorative Proof ingots minted in solid sterling silver. The ingots will be struck for the National Space Institute by The Franklin Mint, America's largest and foremost private mint.

The selections of the 100 subjects for commemoration in this series have been made by the aviation and space experts of the National Space Institute. The first ingot will depict our nation's first aerial voyage—a manned balloon flight that was personally encouraged by President Washington. The last will portray the epochal space voyage of Viking Orbiter I and Viking Lander I to the planet Mars. In between will be magnificent ingots recapturing—in finely sculptured detail—the most dramatic events of America's drive to master the skies and reach out toward the stars.

America's first successful dirigible. The first sustained flight of a powered heavier-than-air craft in the history of man. The introduction of air mail service. The first flight ever to encircle the globe. The aerial conquest of the world's great oceans. The famous bombers and fighters of the Second World War. The dawning of the Jet Age. Breaking the sonic barrier . . .

The development of rocket power. *Explorer I*, the first U.S. satellite to orbit the earth. America's entry into space, with our first manned suborbital and orbital flights. Astronaut Edward H. White's famous "walk in space." The remarkable communications satellite, *Telstar*. *Apollo 11*—man's first lunar landing. *Skylab*, the first laboratory-in-space in history . . .

Heroes of a New Age. In recapturing these dramatic events, the ingots will also honor the famous men and women who have contributed to America's leadership in air and space.

Their names ring down through history. Orville and Wilbur Wright. Glenn Curtiss and "Captain Eddie" Rickenbacker. Admiral Richard E. Byrd. Dr. Robert Goddard, the brilliant American scientist who launched the world's first liquid-fueled rocket. Charles Lindbergh, Amelia Earhart, Wiley Post. Igor Sikorsky, who invented the first commercially successful helicopter. And our heroes of the new age of space, America's astronauts.

In commemorating these great events—and in honoring the men and women who shaped those events—the National Space Institute's *Official Air and Space Ingot Collection* is more than a superb commemorative series. It is the thrilling story of 200 years of American achievement in air and space—captured for all time in the enduring strength of solid sterling silver.

A single, strictly limited edition

As the National Space Institute's first commemorative series, *The Official Air and Space Ingot Collection* will be issued *only once*. And each ingot will be minted *only as a flawless Proof*—individually struck from special dies so that the beautiful frosted design stands out boldly against the brilliant silver background.

These flawless Proof ingots will be issued in a *single, strictly limited edition*. The deadline for subscribing is July 31, 1976, and there is a firm limit of one Proof Set per subscriber. The total number of Proof Sets will be forever limited to *one* for the permanent archives of the National Space Institute and *one* for each individual who subscribes by July 31.

After the edition is completed—when every ingot has been issued to each subscriber—the special Proof dies used in their creation will be destroyed. And none of these historic commemoratives will ever be issued again.

A luxurious collector's chest

To protect and display the complete collection, a custom-crafted collector's chest will be provided to each subscriber. This handsome chest will be fitted with specially-lined drawers to protect and display all 100 commemorative ingots, and will include a permanent nameplate bearing the subscriber's name.

With each ingot, the subscriber will receive a specially-written commentary describing the exciting event depicted. Thus, each subscriber will be able to add to his knowledge of America's historic role in air and in space—while building an impressive collection of finely sculptured official commemorative ingots.

Monthly acquisition plan

The official issue price for each sterling silver Proof ingot in this collection is \$25. Moreover, this price is *guaranteed to each subscriber for the entire series*—irrespective of increases in the costs of minting or the price of precious silver during the subscription period.

Each subscriber will receive one ingot per month, beginning in September 1976, until the collection of 100 is complete. Thus, the subscriber will have the exclusive opportunity to build—month by month—a dramatic official collection of commemorative Proof ingots recapturing two hundred years of American leadership in air and space.

Subscription deadline: July 31, 1976

To subscribe for the National Space Institute's *Official Air and Space Ingot Collection*, you need only fill out the subscription application below and mail it to the official minter: The Franklin Mint, Franklin Center, Pennsylvania.

You need not make any payment at this time. But remember: your application *must be postmarked by July 31 to be accepted*. All applications bearing later postmarks will be respectfully declined and returned.

-----SUBSCRIPTION APPLICATION-----

The Official Air and Space Ingot Collection

All applications must be postmarked by July 31, 1976
Limit: One collection per subscriber

The Franklin Mint
Franklin Center, Pennsylvania 19091

Please enter my subscription for the National Space Institute's *Official Air and Space Ingot Collection*. This collection will consist of 100 commemorative Proof ingots, minted in solid sterling silver and issued to me at the rate of one ingot per month, beginning in September 1976. The official issue price for each sterling silver Proof ingot is \$25.*

I understand that I need send no money now. I agree to pay for each ingot promptly upon being billed with its shipment. I further understand that a custom-crafted collector's chest will be sent to me separately, without additional charge. *Plus my state sales tax

Signature _____

All applications are subject to acceptance by The Franklin Mint.

Mr. _____
Mrs. _____
Miss _____

PLEASE PRINT CLEARLY

Address _____

City _____

State, Zip _____

Canadian price: \$26. per ingot, plus provincial sales tax, if any. Mail application to The Franklin Mint Canada Ltd., 70 Galaxy Blvd., Rexdale, Ontario M9W 4Y7.

The Franklin Mint is the world's largest private mint. It is not affiliated with the U.S. Mint or any other government agency.



Subscription Deadline: July 31, 1976
 Limit: One Set per Subscriber



*An open letter from
 Dr. Wernher von Braun,
 Chairman of the Board of
 the National Space Institute*

NATIONAL SPACE INSTITUTE
 1911 N. Fort Myer Drive, Suite 408
 Arlington, Virginia 22209 703-525-3103



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Dear Friend:

It is a little-known but fascinating fact that America's leadership in air and space began some two centuries ago, when President George Washington officially endorsed -- and personally encouraged -- America's first manned balloon flight.

In the years since, this country's leadership has been affirmed again and again by the achievements of air and space pioneers such as the Wright Brothers, Charles Lindbergh, Amelia Earhart and our American astronauts. And I am convinced that history will remember the 20th century more for its great positive accomplishments in air and space than for its work in any other field.

In order to keep this nation advancing as a world leader, we at the National Space Institute have dedicated ourselves to do all in our power to communicate the benefits of America's air and space program. For the gift of flight and the achievements of space exploration have given this country a new perspective -- and great confidence in our ability to achieve -- as we look ahead to the future.

Now, as we celebrate the United States Bicentennial, it is fitting that there should be a permanent record of this nation's great accomplishments in air and space. And so we have resolved to issue a comprehensive collection of commemorative ingots paying tribute to the people and events that have given America her enviable record of greatness in air and space.

I am pleased to commend this collection to your personal attention.

Cordially,

Wernher von Braun
 Chairman of the Board

WVB:EV



"Make it beautiful,
craft it lovingly, and offer a variety of styles.
People will love it."

A simple philosophy. But most effective.
With it, we've made the GMC MotorHome
something that captures the imagination.

We made it sleek. We made it low. We made it
so it would slip through the air easily and handle
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But that wasn't enough. We decided to offer it in
a variety of models, in order to satisfy a variety of
needs. There are three 23-foot versions. Each with
its own floor plan. An all new, 26-foot, twin-bed

model. And three particularly luxurious 26-footers.
The Glenbrook, Palm Beach, and Eleganza II.

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the same. And that's the thing we wanted most to
offer the buyer: quality. Quality supported by a
nationwide dealer network. One stop. For everything.

One more thing we have to offer. A handsome
4-color catalog that goes into a lot more detail.
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AMERICA JUST AS **LANDSAT** DOES

NEW GE SPACE PORTRAIT SHOWS
RESOURCES AND FEATURES IN BRILLIANT
COLORS USED BY SPACE SCIENTISTS
FOR MAXIMUM DETAIL AND DEFINITION

Barry Bishop's authoritative article in this issue tells why the Landsat satellite, from 576 miles in space, sees our country differently — and better — than the human eye can. It explains how the satellite "eye" pictures vegetation in red, other features in contrasting colors, to produce dramatic and informative portrayals of the earth's resources and features.

Now you can have your own handsome photographic print, in larger sizes which will enable you to pick out landmarks and features just as earth resource scientists do!

See the glory of America's croplands and forests, rivers and lakes, plains and mountains, cities and deserts! Own this stunning portrayal of your country! You can study it for a lifetime without exhausting its fascination. Frame it for dens, family rooms, libraries. Makes the perfect gift.



This miniature only hints at the beauty of the Space Portrait

Available in three large sizes.

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Send me my unique Space Portrait of America by return mail, in the size I have indicated. I enclose payment in check or money order (no cash, please).

16 x 24 in. \$20.00 Plus \$1.00 Handling

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I am interested in larger, mural-size prints. Please send information.

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GENERAL  ELECTRIC

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We know you'd like better photographs than you can coax out of your pocket camera. But if you think finer photography is a complex problem, you really ought to try our simple solution: The Pentax K2. It takes the guesswork out of fine photography.

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People who love Pentax (and there have been more Pentax 35mm cameras sold than any other) know it has a comfortable, distinctive "feel." And, thanks to automatic electronic wizardry, the K2 is practically a genius at giving you perfect pictures.

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This precision engineered Pentax can be as simple to operate as your pocket camera. All you have to do is put some film in (even Pentax still requires that!), aim, focus, and shoot. Your K2 will make sure that what you see is what you get.

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**The Colonial Mint announces
 "The Endangered Species of North America"
 limited edition sculpture collection created in fine
 pewter or sterling silver.**



American Bald Eagle
 Wing span: 6 3/4"
 1 pound, 12 ounces of solid pewter

To preserve its rarity and enhance its potential as a growth investment this beautiful series of eight sculptures will be a strictly limited edition.

In less than 200 years our continent went from a vast naturalist's Eden swarming with wildlife to a land of cities and towns where animal species cannot roam. Now, as a tribute to our natural heritage, The Colonial Mint has commissioned the creation of *The Endangered Species* sculpture collection. Eight animals have been immortalized in extraordinary anatomical detail by the distinguished sculptor and naturalist, T. M. O'Brien.

The American Bald Eagle will be hand cast of 1 pound, 12 ounces of fine pewter, or 5000 grains of .925 pure sterling silver.

Each statue will be meticulously hand cast by master craftsmen in the "sculptor's metal," warm, rich pewter. Or, for the truly discriminating collector, a special heirloom collection is available in sterling silver.

The molds will be donated to the Smithsonian and never used again.

There will be only one limited edition of *The Endangered Species*.

It is being made available on an advance subscription basis exclusively. The total edition will be strictly limited to 9,500 collections with a limit of one collection per subscriber.

The future investment value.

We can't be certain of what will happen to future values in the art collector's market. But, we do know that in recent years museum-quality sculptures such as these have escalated in value because of their artistic merit and their excellent potential as a hedge against inflation.

The convenient terms of The Colonial Mint acquisition plan.

The eight statues in this collection are the *American Bald Eagle, Grizzly Bear, Eastern Cougar, Wood Bison, Alligator, Whooping Crane, Red Wolf and Pronghorn Antelope*. They will be made available on a one-a-month basis to charter subscribers. A new sculpture will be issued every month at the original price of \$65 (the deluxe edition in silver \$195), which is guaranteed throughout this issuance period only to charter subscribers.

Included free with each collection will be *Vanishing Wildlife of North America* published by The National Geographic Society.

Each subscriber will be issued a numbered certificate to verify that his collection is one of the original limited edition.

The Colonial Mint

228 B Monticello Avenue
 Williamsburg, Va. 23185

Gentlemen: Please enter my subscription to *The Endangered Species of North America* sculpture collection. I understand that the first sculpture I will receive is the American Bald Eagle.

I want my collection cast in:

- Solid pewter at \$65 each
- Sterling silver at \$195 each

With this reservation, I enclose my payment for the first sculpture. Or, please charge to my credit card.

- Master Charge BankAmericard
- American Express

Account Number _____

Expiration Date: _____

Name _____
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State, Zip _____

(Signature) _____

What a way to



THRIFTY



TIME



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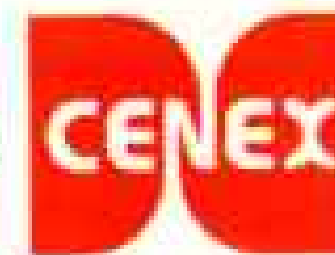


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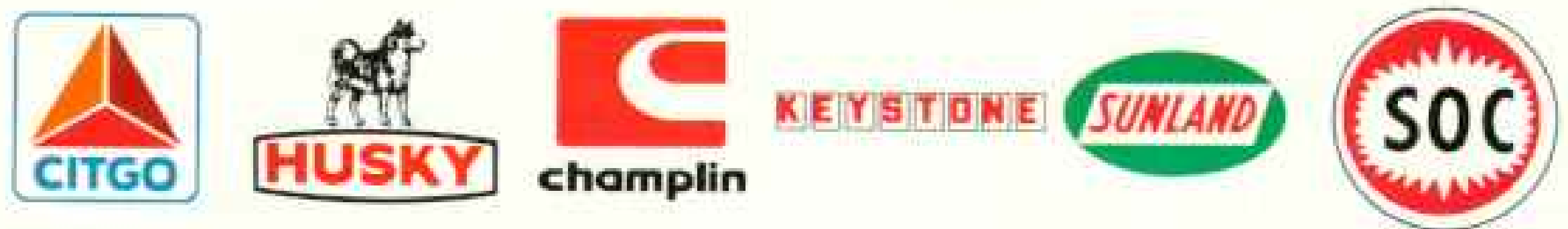
You're looking at some of the brands and names of companies that sell gasoline. Some people say oil companies are a monopoly. If so, it's the world's most inept "monopoly."

This "monopoly" is so inept that it offers the world's richest country some of the world's most inexpensive gasoline.

This "monopoly" is so inept that it lets everybody and his brother horn in on the action. Did you know that of the thousands of American oil companies, none has larger than an 8.5% share of the national gasoline market?

In fact, this "monopoly" is so inept that you probably wouldn't recognize that it is a monopoly

run a "monopoly!"



because it looks so much like a competitive marketing system.

People who call us a monopoly obviously don't know what they're talking about.





Andersen the Beautiful,

From colonial New England to the free-spirited West Coast. From the rustic Northland to the enchanting South.

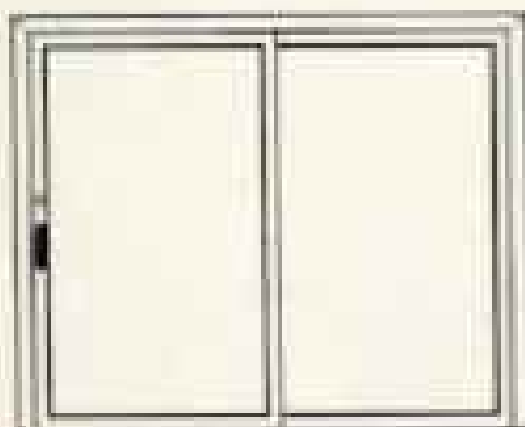
Whatever your lifestyle, wherever you live, Andersen® Windows and Gliding Doors capture it beautifully.

In the warmth, charm and character of their interior wood trim.

In their crisp, clean lines and uncluttered view. And in the quality that comes from over 70 years of dedicated craftsmanship and close attention to detail.

A beauty that's reflected in Andersen's use of wood and double-pane insulating glass, both excellent fuel-savers.

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Traditional beauty without the traditional bother. Frame is rigid vinyl. Sash is protected by a weather-resistant, long-lasting polyurea finish.

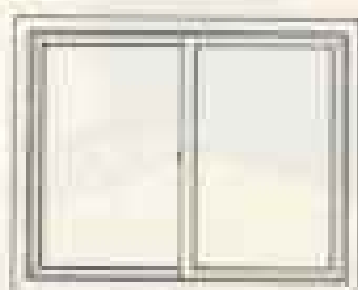


from sea to shining sea.

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With Perma-Shield® vinyl-clad Windows and Gliding Doors, there's the added benefit of low upkeep.

So whatever your idea of home may be, Andersen Windows and Gliding Doors can help



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Please send your free window and gliding door ideas booklet.
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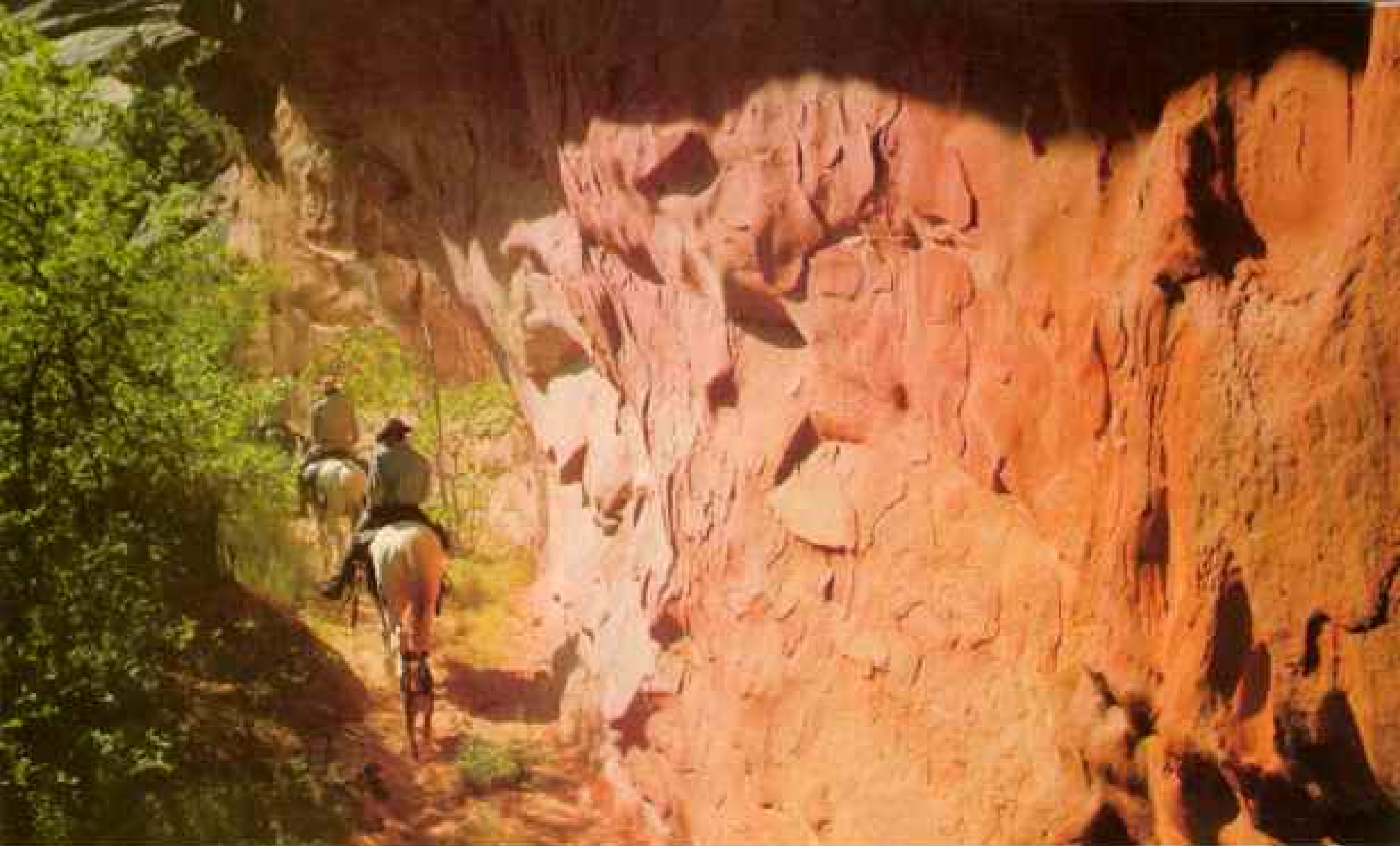
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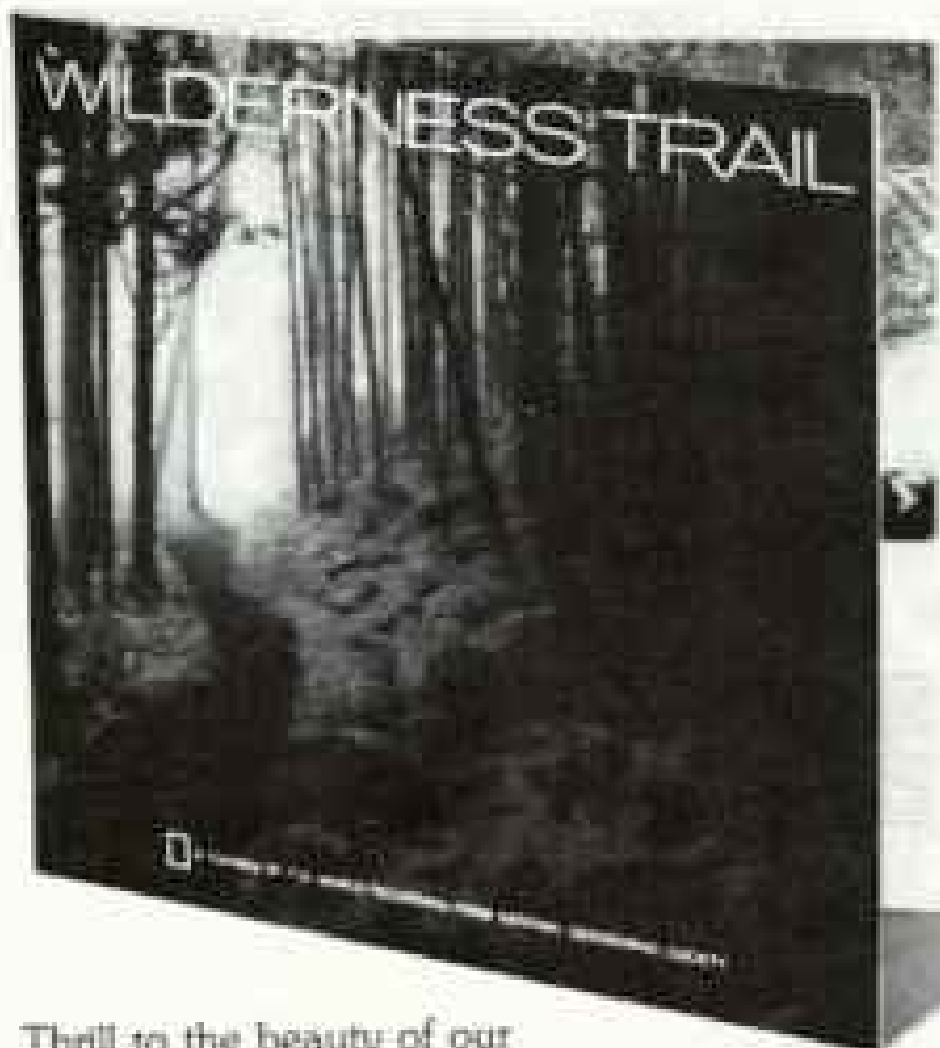
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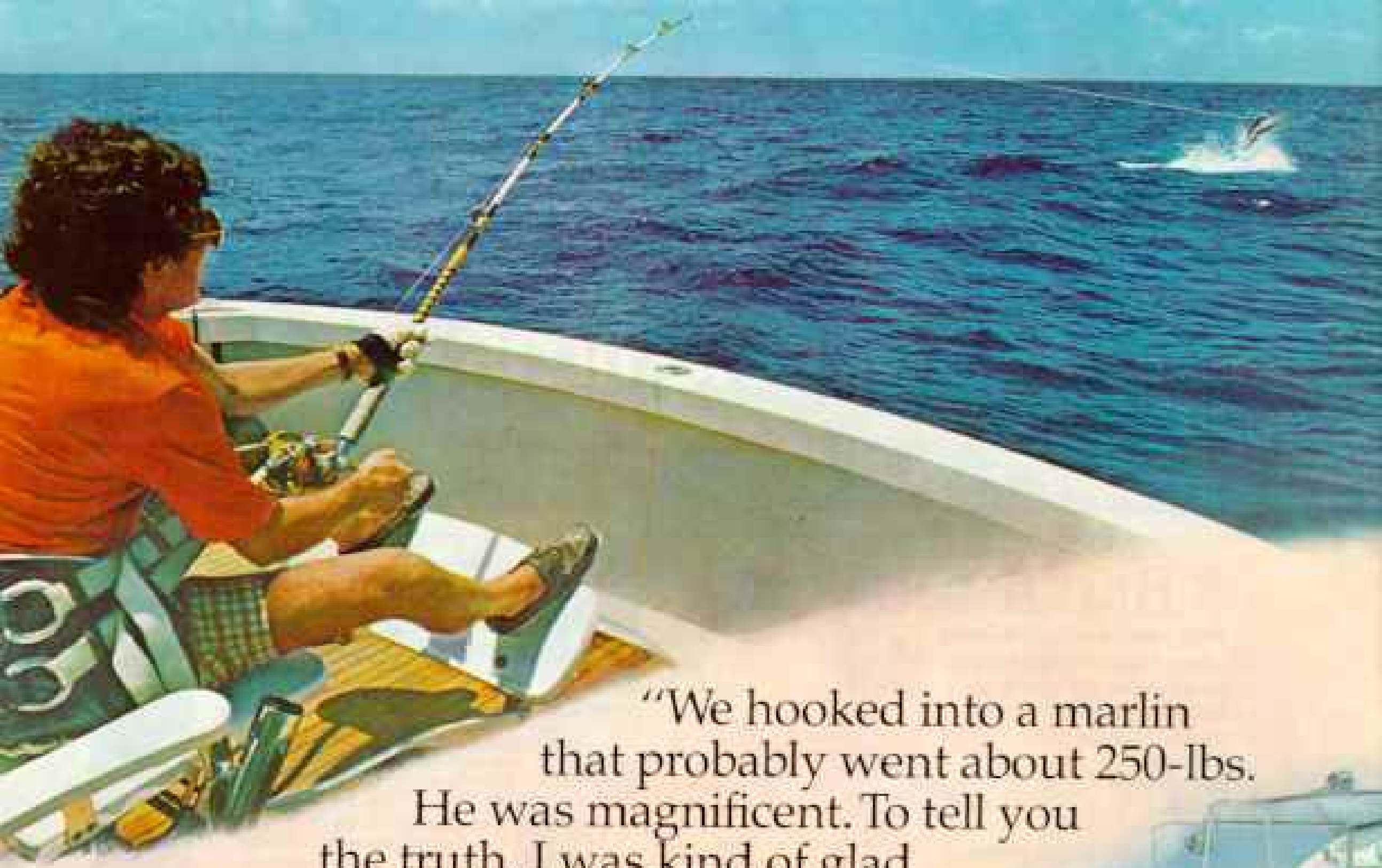
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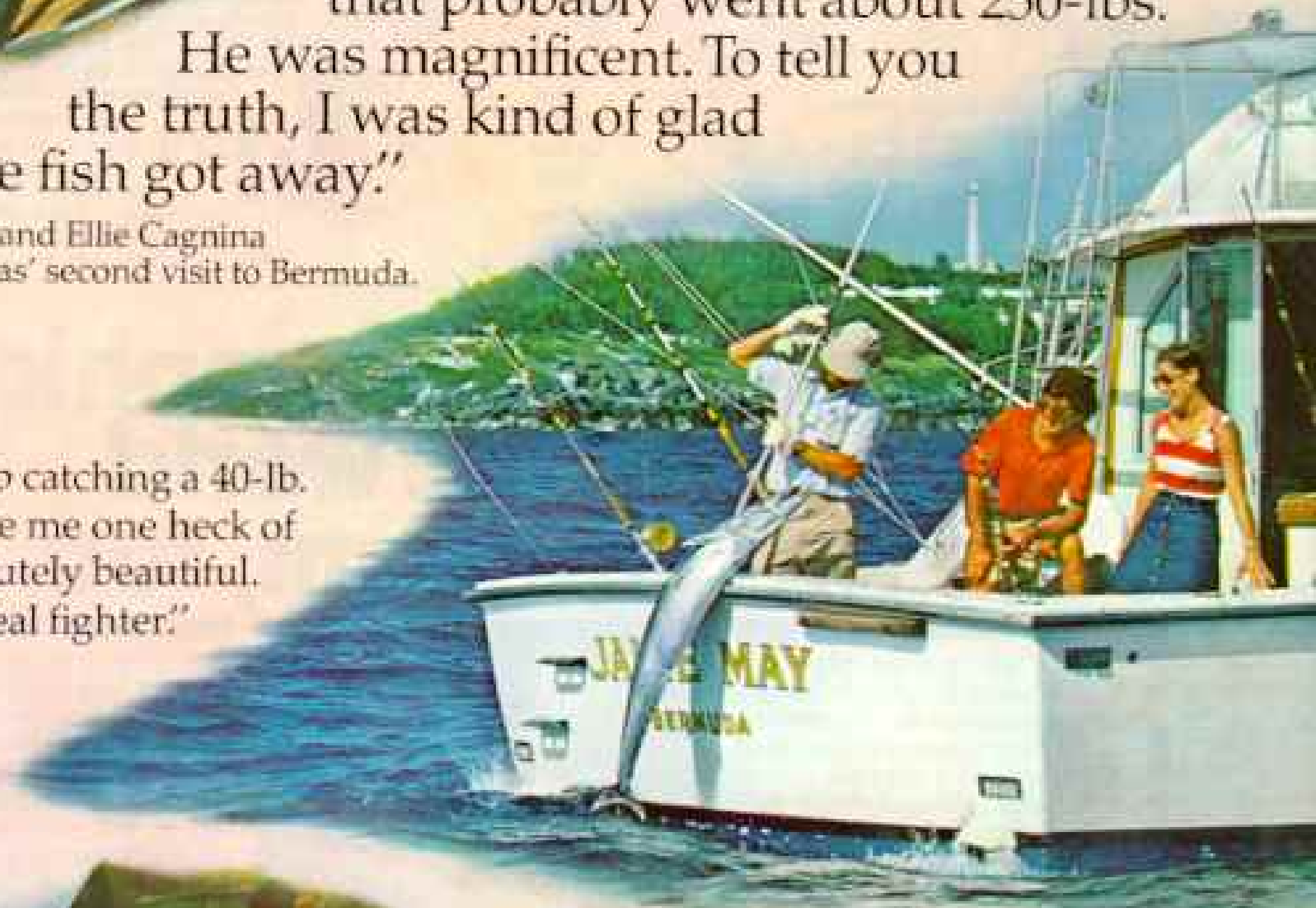
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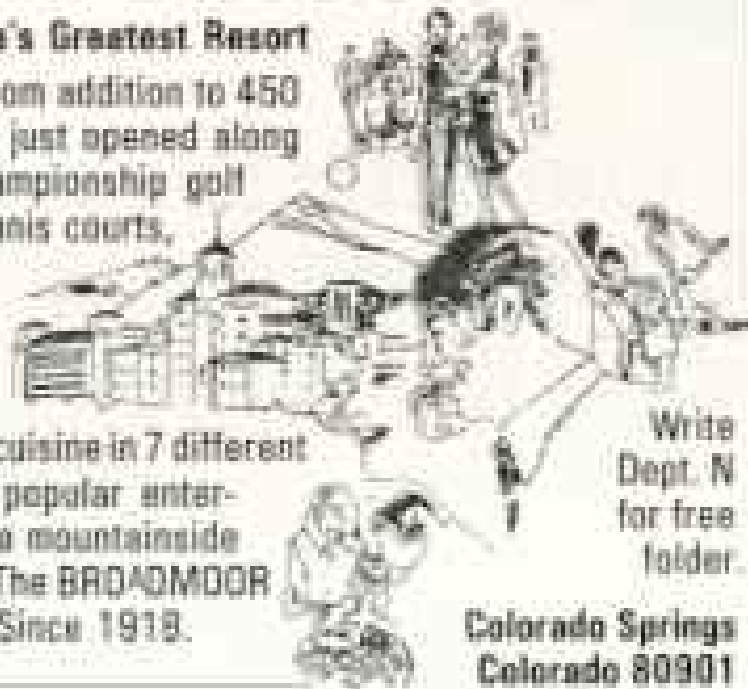
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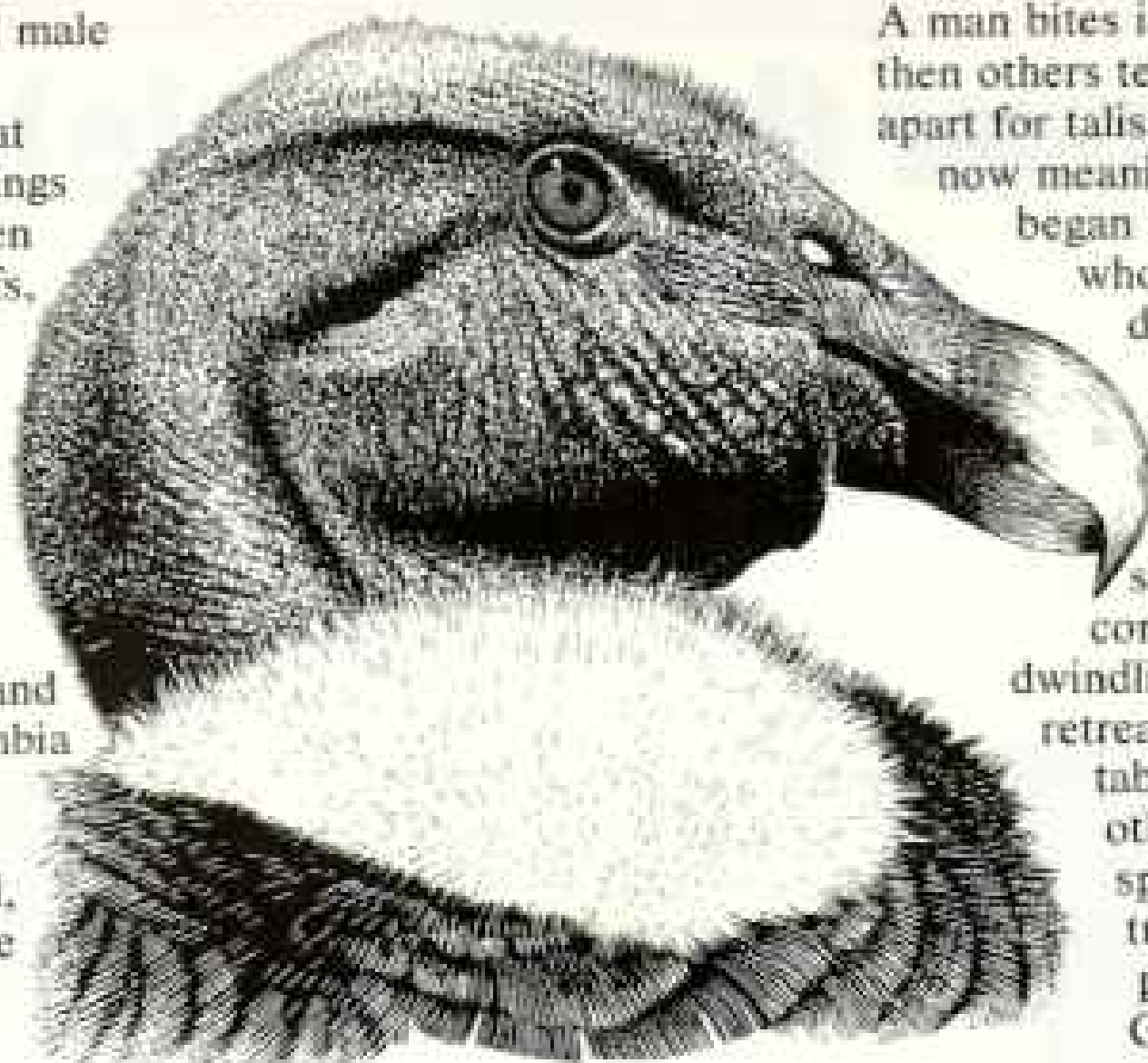
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Is time running out for the mighty condor?

Profile from the past, the Andean condor has changed little since prehistoric times. Beady red eyes, hooked beak, and white ruff mark the female. The paler-eyed male wears a crinkled crest. Giants among birds that fly, condors soar on wings spanning as much as ten feet. Leaping from cliffs, condors ride updrafts to three-mile altitudes, attaining speeds of 35 miles an hour. Wings flap sparingly, mainly for takeoffs and landings. Andean condors haunt coasts and mountains from Colombia to Tierra del Fuego, feeding mostly on carrion. Once plentiful, their numbers decrease as humans encroach on their wild domain.

Hunters bag them for trophies. Guardians, hired to protect guano birds on Peru's offshore islands, wantonly slaughter condors on the mainland. One



village ceremony also takes a grisly toll. A captive bird is swung from arched poles, and Cashapampa's fist-swinging horsemen pummel it to death. A man bites its tongue out, then others tear the creature apart for talismans. The rite, now meaningless, apparently began with the Spanish, who symbolized destruction of the Inca's pagan culture by killing condors. Their cousins, the few surviving California condors, cling to dwindling mountain retreats. Readers keep tabs on these and other endangered species by regularly turning to the pages of NATIONAL GEOGRAPHIC.

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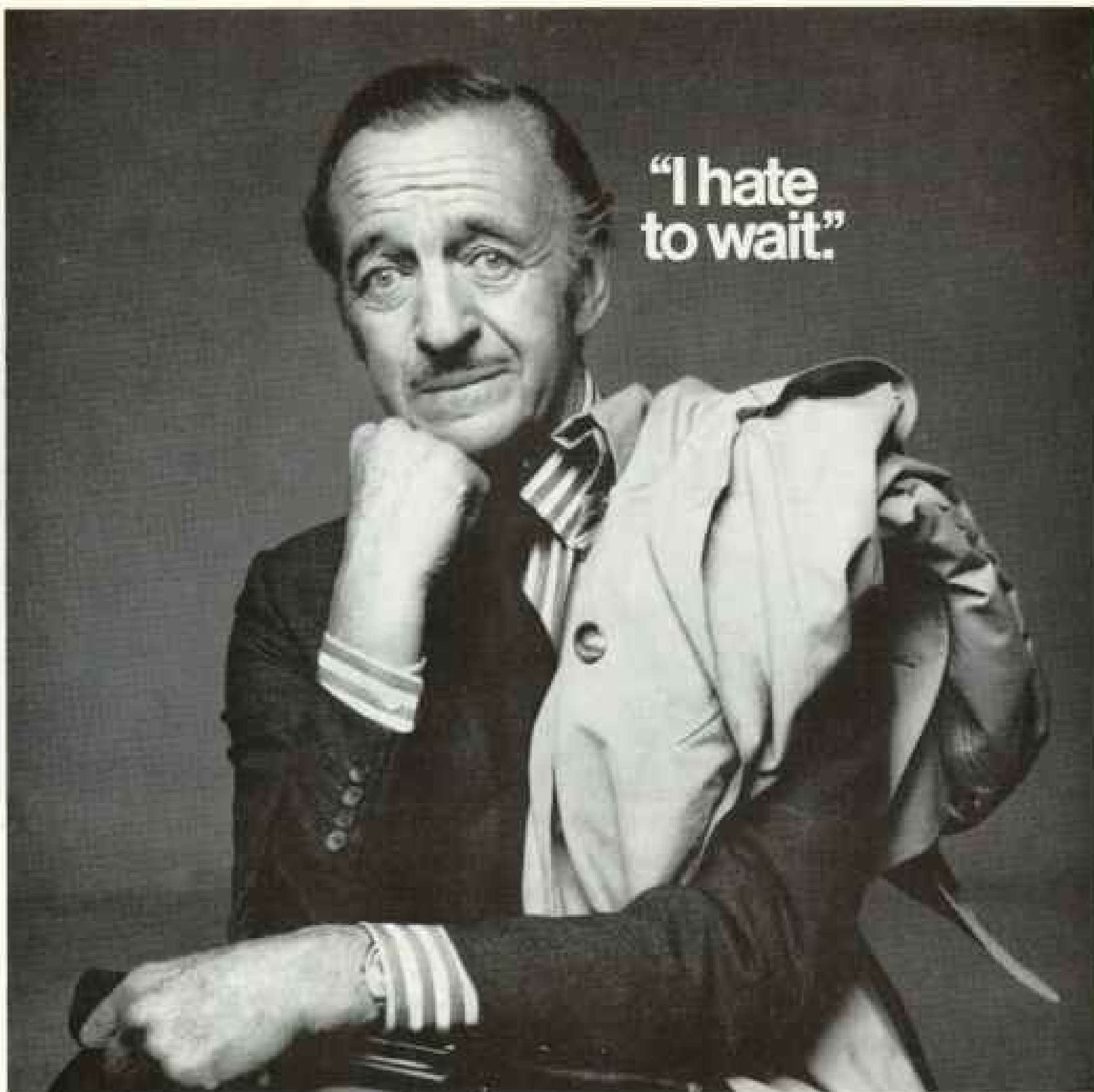
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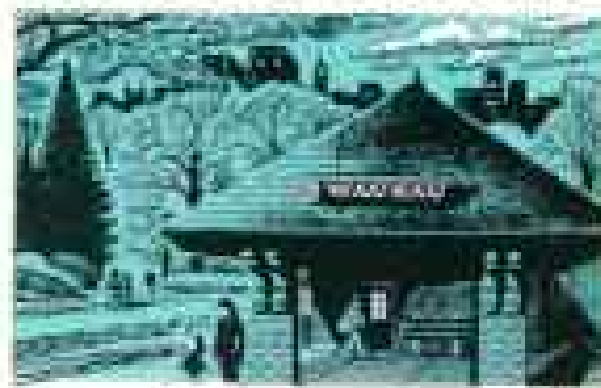
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