



əfilbliW to svəbnətəD to ənizagaM

3861 γαρυαγγ/γερνααγγ

FEATURES

81

17

8

gniloH thgiwU vd Yed is ets J gid t

hunting of California's embattled mountain lions. Conservationists are fighting to keep a moratorium on trophy

California researcher. Better-informed biologists, not hunters, are the key, declares a olliver Jeven de Treville Coping With Cougars

A landmark law is up for reauthorization, and what happens will affect by John M. Fitzgerald and Roger Di Silvestro 1985: Crucial Year for the Endangered

unday : J uyof dq Retreat in the Barrens

the fate of much rare wildlife.

sign of what is happening to a special habitat. The dwindling of the Northeast's pine barrens buck moth is a tell-tale

uonays saidon ka Kainji Lake: Nigeria's Park of Promise 30

threatened by poaching and habitat depletion. A West African nation is stepping up its efforts to save animals

siseO anosirA 38

Aravaipa Canyon becomes part of the wilderness system.

DEPARTMENTS

97 Roundup by Roger Di Silvestro 14 Defenders View by Allen E. Smith Crusade for Wildlife by Michael Frome 98 Issue Reports 40

E. R. Degginger, is one of the more celebrated of the wildlife species protected peregrine falcon, here a female photographed with a ring-necked pheasant by 4). Photo by Gary Milburn from Tom Stack and Associates. Opposite: the renewal of a han on lion trophy hunting that has been in force since 1972 (page California it is a focus of controversy, for sportmen's groups hope to prevent the Mississippi, is still an impressive presence in the West. But this year in COVER: The mountain lion or cougar, now only a legend in most states east of

by the Endangered Species Act, up for reauthorization this year (page 12).

Napier Shelton, Field Correspondents

William W. Betts, Jr., Gary L. Bogue,

Delphine Haley, Jack Horan,

Tony Auth, Contributing Cartoonist Page Chichester, Assistant Editor Roger Di Silvestro, Articles Editor James G. Deane, Editor

class postage paid at Washington, D.C.







estate tax purposes.) Single copies: \$3. Second gifts and bequests are deductible for gift and are deductible from federal taxable income; nal subscription charge, and all contributions, States and Canada. (Dues in excess of \$10 nomiof Wildlife. Annual active membership dues: \$20. Add \$2 mailing charge outside United not necessarily reflect the policy of Defenders views expressed in DEFENDERS magazine do companied by proper postage. The individual and art work, which will be returned only if acsponsible for unsolicited manuscripts, photos ington, D.C. 20036. All rights reserved. Not re-Wildlife, 1244 Nineteenth Street, N.W., Washwildlife. Copyright © 1985 by Defenders of dedicated to the preservation of all forms of nonprofit national educational organization every other month by Defenders of Wildlife, a DEFENDERS, ISSN 0162-6337, is published

RETREAT IN

The dwindling of the Northeast's pine barrens buck moth is a tell-tale sign of what is happening to a special habitat







OUCHED by the rising sun, the ancient pine barrens flamed in brilliant scarlet, russet and ochre as their mantle of low shrubs caught the light. Columnar pitch pines with gnarled crowns towered in deep green silence around us. We waited expectantly as mists in the interdune swales dissipated and the chill of night evaporated into a clear, crisp day.

Several hours went by as we scanned the dune crests and hollows. The sun rose toward its zenith. We were beginning to lose hope, and my companion, Don Rittner, archaeologist, pine barrens expert and president of the American Pine Barrens Society, actually started to say, "Maybe this is it." But suddenly he gave a shout and pointed to the next dune ridge. There, flying rapidly in the golden October sunshine, its bold black and white wings brilliantly contrasting with the multicolored foliage, was the object of our pilgrimage, a buck moth. Don gave a sign of relief. The moths would fly this fall; the Pine Bush population would survive for at least one more year.

Don and I were standing atop the



highest dune in the Albany Pine Bush, perhaps the most famous surviving fragment of the East's once expansive pine barrens habitat. To get there we had waded through chest-high scrub oaks, repeating a ritual that has taken us to the same spot early every October for more than a decade. We do this out of scientific interest coupled with morbid curiosity, for these visits constitute a kind of death watch. We are observing a slow, lingering demise, but also a premature and tragic one, unwitnessed by any except the two of us.

Buck moth. It is a strange name for a strange and wonderful insect. Eighteenth century English entomologists, upon receiving the first specimens from the colonies, named it the "crepe moth" because its color—coal-black except for striking white wing bands and crimson body trim—reminded them of crepe paper hung in mourning. The later appellation "buck moth" was conferred by outdoorsoriented Americans who associated the appearance of the moths with the deer-hunting season. Perhaps the earlier name was more apt, as it presaged its 20th century fate. The buck moth may be the only endangered species dressed for its own funeral.

For the buck moth is dying out in the Northeast, population by population, as its pine barrens habitat is consumed by development. Along with the buck moth, an entire unique, beautiful and specialized biota is disappearing as well. The crepe moth mourns not only its own plight but that of the other rare and declining pine barrens species that share its home.

Buck moths always have been rare and localized because their populations are tied to plants found only in pine barrens—various small or dwarf

THE BARRENS

by John F. Cryan





This sequence, drawn by biologist John Cryan, shows a buck moth in flight. In the Northeast, buck moths are found only in pine barrens, areas rapidly disappearing as development overwhelms the East. Buck moths begin their lives as caterpillars that feed in groups on the leaves of the scrub oak species characteristic of the barrens. The caterpillars go through six stages of growth, called instars, before reaching a full two-and-a-half-inch length. Then they burrow underground for their transformation into winged moths.

oaks that are the caterpillars' only food. The commonest of these is scrub or bear oak, which along with its relatives never reaches tree size. These dwarf oaks form the middle layer of a three-tiered, savanna-like vegetation characteristic of all pine barrens. The upper layer consists of widely spaced pitch pines. The lower layer is dominated by the heath family-blueberries, huckleberries, bearberries, winterberries, laurels and others-together with many rare wildflowers, grasses and other herbs. Pine barrens really are not barren at all. They contain thousands of species, many of them unfortunately among the Northeast's rarest and most imperiled.

Like other pine barrens species, the buck moth is remarkably adapted to the two natural features that create and sustain pine barrens: dry, strongly acidic, nutrient-poor soils and frequent natural wildfires. All of the Northeast's two dozen or so scattered pine barrens are dominated by pitch pine, the most fire-adapted tree in the Northeast. Because these unusual conditions are seldom found, pine barrens vegetation is the rarest major type in the Northeast.

Buck moths arose from a group of southwestern United States moths called the "day" or "sheep" moths, genus *Hemileuca* ("half-white"). These boldly colored insects are day fliers and like the buck moth have poisonous caterpillars and favor dry, inhospitable habitats—sagebrush, semi-desert and chaparral.

The first buck moths probably moved eastward from the deserts during warm interglacial periods hundreds of thousands of years ago, becoming adapted to the southeastern equivalents of pine barrens—hard pine and oak woodlands and thickets of the coastal plain, Mississippi Valley and dry ridges in the Appalachians. As glaciers waxed and waned, the range of the buck moths contracted and expanded following shifts in climate and vegetation, especially the distribution of shrubby oaks required by the caterpillars.

Buck moths may have occupied the Northeast many times, only to be driven out by each glacial advance before their most recent colonization from the south following the retreat of the last glacier 23,000 years ago. Their present distribution in scattered colonies along the Gulf Coast and up the Atlantic coastal plain to southern Maine is a reflection of the buck moth's desert origins and its selection of the driest, most fire-swept habitats within its range.

The life history of the buck moth is a triumph of adaptation over a harsh environment. To avoid wildfires, most common from February through May, and summer droughts, adult buck moths emerge from their subterranean pupae and fly in fall, starting in late September in the northern end of their range and ending in December in the southern end. The moths are active only from midmorning to midafternoon, avoiding fall night temperatures that frequently drop toward freezing. Their predominantly black coloring enables the moths to warm themselves rapidly for flight in the bright sunlight. Their white and red markings serve a protective purpose-they warn migrating birds that the moths are very distasteful and should be avoided.



After emerging from their pupae and expanding their wings, female moths hang motionless from twigs and "call," releasing not sounds but a chemical sex attractant, or pheromone, which drifts hundreds of yards in the wind. The smaller males, stimulated by the females' perfume, fly into the breeze, using their large, sensitive antennae to follow the scent. The mating flights of the males, patrolling back and forth over the low shrubs, are spectacular.

The moths concentrate in large numbers in suitable scrub oak thickets. An efficient locating system is especially important for the buck moth, because adults do not feed and live only a few days on stored fat reserves.

Once mated, females take off in dispersal flights that may carry them miles away. After locating by sight and scent the dwarf oak species required by the caterpillars, the moths settle down and lay broad bracelets of eggs around the twigs. Each ring contains up to 200 eggs, and each egg is wax-coated to prevent desiccation. Soon after laying their last eggs, the female moths die.

The eggs overwinter, the caterpillars developing inside but remaining dormant, protected from the cold by the natural antifreeze that gives the greenish color to insect blood. In May, usually after the last fires, tiny black caterpillars crawl out and cluster on the oak leaves. Even in their earliest stages the caterpillars are protected by stinging spines that cause painful rashes if touched. The larvae feed in groups on tender new foliage, growing rapidly over a two-month period. They molt their skins five times to accommodate their increasing bulk.

By July they exceed two inches in length and are fat and sleek. After their third or fourth molt, caterpillar clumps break up and each individual crawls alone to a new shrubby oak. By dispersing, the caterpillars reduce their chances of falling victim to their only successful predators—tiny parasitoid wasps and flies that in the pine barrens lay eggs exclusively on the buck moth caterpillars. The larvae eat the fat reserves of the caterpillars, preventing them from metamorphosing into adults.

As buck moth caterpillars mature, distinct differences begin to appear among the various populations. New Jersey caterpillars become dull greyish with cream-colored bands. On Long Island they develop brilliant lemonA male buck moth, bottom left, has thicker antennae than the female. These are used during the mating season to locate females, which give off a special odor. Eggs are laid in bands on the twigs of oak trees.

yellow stripes alternating with deep black. Those in the Albany Pine Bush grow much larger than caterpillars in other populations and have no bands or stripes at all—they stay pure black with beautiful white speckled patterns, like star maps. Along with differences in host species preferences, adult size and coloring, population density and other traits, these variations make each buck moth population distinctive and easy to distinguish.

Isolation in separate pine barrens with different selection pressures has made each population genetically distinct and well-adapted for life in its particular home area. Many other pine barrens species show similar variations among their scattered populations. Biologists recognize that such small, isolated populations often are species in the making, especially if their habitats endure and change as time passes. One of the arguments for saving pine barrens and similar distinct habitat islands was put succinctly by my friend and colleague, Robert Dirig of Cornell University, who called them "species nurseries."

When they reach their sixth and final instar, or period between molts, buck moth caterpillars prepare to enter the resting stage. They crawl down and burrow into the loose, sandy soil to dig small chambers about two inches below the surface. Within these cells they shed their skins for the last time, exposing hard, black, mummy-like pupae. For the remainder of the summer, including the drought- and fire-prone months of July, August and September, they rest undergound.

If rainfall is plentiful in late summer, most pupae will develop into adults in October. Occasionally, however, pine barrens will be stricken by aridity that may last many years. In such cases a remarkable adaptation inherited from the buck moth's desert ancestors comes into play. The pupae fail to develop and emerge in the first fall. Instead they overwinter and emerge the following fall. If the drought continues through a second season, the pupae will wait until the third. I have kept some hand-raised









Buck moths from geographically isolated pine barrens can be distinguished even in the caterpillar stage. The full-grown caterpillar at top is from the Albany Pine Bush and is larger than the rest, as is the adult moth. A New Jersey pine barrens caterpillar, center, shows typical dull coloring, while the Long Island caterpillar, left, is marked with bright bands. Some biologists think that buck moths such as these, representing isolated populations, are beginning to differentiate into new species. Above, the Atlantic is a thin blue line three miles beyond Long Island pine barrens.



pupae dry for four years, yet they still were able to produce healthy moths in the fifth autumn. This desert adaptation is a key to the buck moth's ability to survive and prosper in pine barrens, for there is always a sizable reserve of pupae resting undergound, where they survive not only droughts but the raging wildfires spawned by them.

All of these wonderful adaptations for pine barrens life are useless against the latest threat, which Don Rittner calls "the human glacier." Like the last ice sheet, it is grinding across much of North America and the rest of the globe, obliterating the thin mantle of life as it goes. Unlike its natural predecessors, however, this particular form of "glaciation" is selective, sparing some regions while

A buck moth in the Long Island Oak Brush Plains lays her egg ringlet, a process that can take more than two hours. Fires like this one in Long Island pine barrens repress growth of invading shrubs and trees that could choke out barrens species. ravaging others. Pine barrens have been hit especially hard because many of them are in the path of the expanding northeastern megalopolis stretching from Boston to Washington, D.C.

Unfortunately, many pine barrens are located in ideal places for human settlement.

Pine barrens are postglacial relics. Their distribution in the Northeast has been determined by the glacial history of the region. About 26,000 years ago, the last advance of the Wisconsin glaciation reached its maximum land coverage. When the ice receded, sandy coastal plains and deltas were exposed. As the climate warmed, pine barrens plants and animals slowly migrated northward from the deep south, moving up the lowland areas and using dry ridges as stepping stones to colonize areas with droughty soils. The postglacial climate reached its peak of warmth and aridity about 8,000 years ago, during a period known as the Xerothermic or Hypisthermal Interval. At that time, the buck moth and thousands of other pine barrens species reached their maximum extent, penetrating to northern New York, Massachusetts, New Hampshire and Maine. During the Xerothermic Interval, pine barrens vegetation covered far larger areas than it does now. Some of the barrens that are now isolated were then linked.

As the climate cooled and became wetter, a trend that has continued to the present, the barrens shrank and receded to their present disjunct distribution. When European settlers arrived in North America, pine barrens ecosystems covered only about 1.8 million acres scattered across two dozen major locations in eight states, or less than two percent of the land in the Northeast.



SPECIES AT RISK

THE BUCK MOTH is only one of many pine barrens species in trouble. Hundreds of plants and animals found wholly or mostly within these fire-dependent woodlands face varying degrees of population losses or extirpation. A sampling of imperiled creatures of pine barrens and related heathlands and dunelands:

Karner Blue Butterfly (Lycaeides melissa samuelis). Listed as endangered in New York and a candidate for federal listing. Named by famed novelist Vladimir Nabokov for a ghost town in the Albany Pine Bush. Tiny remnant colonies in New Hampshire, New York and Ontario and localized colonies in four midwestern states are losing out to habitat destruction.

Regal Fritillary Butterfly (Speyeria idalia). Proposed as endangered in Massachusetts; proposed for federal listing. Once found in many moist lowlands and coastal moorlands of the Northeast. Now restricted to four islands—Martha's Vineyard, Nantucket, Block Island and Long Island. Destruction of heathlands, loss of host violets and spraying are the causes of decline.

Precious Underwing (Catocala pretiosa). Proposed for federal listing. First discovered in the Albany Pine Bush and once found in many pine barrens. Mysteriously disappeared from the Northeast at the turn of the century. Rediscovered recently in the New Jersey Pine Barrens.

Plymouth Red-bellied Turtle (*Pseudemys rubiventris bangsi*). Listed as endangered both federally and by Massachusetts. Found only in a few glacial kettle ponds in southeastern Massachusetts. Suburban sprawl threatens habitat.

Pine Barrens Tree Frog (Hyla andersonii). Listed as endangered in New Jersey. New Jersey and North and South Carolina populations are candidates for federal listing. Suburban development and retirement villages threaten prime New Jersey populations.

Pine barrens populations of the following widespread species are in jeopardy:

Tiger Salamander (Ambystoma tigrinum). Listed as endangered in New York and New Jersey. Declining

rapidly in the Northeast because of destruction of breeding ponds. Its major stronghold in the Long Island Pine Barrens, its northern limit, is jeopardized by suburbanization.

Whip-poor-will (Caprimulgis vociferus). Rapidly losing its prime breeding grounds in the Northeast, where remaining populations are centered in pine barrens.

Eastern Bluebird (Sialia sialis). Listed as a "species of special concern" in New York. Once a common pine barrens bird, declining rapidly because of habitat disturbance, fire suppression and gypsy moth spraying.

Prairie Warbler (Dendroica discolor). Major Northeastern breeding habitats in shrubby oak thickets are shrinking because of development and fire suppression.

One that did not make it: The heath hen. This relative of the greater prairie chicken lived exclusively in pine barrens and was so abundant in colonial times that laws were passed to prevent landowners from feeding it to their servants every day. Its extinction resulted from both excessive market hunting and habitat destruction-ironically by too many fires ignited by sparks from trains passing through heavily logged pine barrens piled with slash. Efforts to captivebreed it and restore habitat came too late. The last bird died on Martha's Vinevard in 1932.

The following pine barrens plants are candidates for federal listing: Boykin's Lobelia (Lobelia Boykinii) Pine Barrens Boneset (Eupatorium resinosum)

Knieskern's Beaked-rush

(Rhynchospora knieskernii) Sandgrass (Calamovilfa brevipilis) Barratt's Sedge (Carex barrattii) Parker's Pipewort (Eriocaulon parkeri) Swamp Pink (Helonias bullata)

Torrey's Muhly Grass (Muhlenbergia torreyana)

Yellow Asphodel (Narthecium americanum)

Hirst's Panic Grass (Panicum hirstii) Long's Bulrush (Scirpus longii) Sand Plain Gerardia (Agalinus acuta) American Chaffseed (Schwalbea americana)

—John F. Cryan









Clockwise from above left: Biologist Cryan lures male buck moths to caged

females in Long Island barrens. Some state-listed barrens species: In New Jersey, a pine barrens tree frog and a thread-leaved sundew, a plant that feeds on insects trapped by its sticky leaves. In Massachusetts, a Plymouth red-bellied turtle. On Long Island pond ice, a tiger salamander.



Unfortunately, many pine barrens are located in ideal places for human settlement—the lowlands near coasts, harbors, rivers and lakes. Outright habitat destruction by land clearing and development over the 300-year history of the Northeast has claimed almost a million acres of pine barrens, half their original coverage. Within the remainder, rates of development and loss of natural land are increasing.

Pine barrens were named by colonial farmers who shunned them because crops grown there failed and livestock were poisoned by unfamiliar plants such as sheep laurel and goats-rue. The largest pine barrens were found along the northeastern Atlantic coast—South Jersey, Long Island, Cape Cod and the nearby islands. Later, settlers discovered sandy pockets of pitch pine and scrub oak in isolated inland sites near rivers and rocky barrens on exposed ridgetops. Many of these places eventually became important settlements. Concord in New Hampshire, Springfield in Massachusetts and Glens Falls in New York were founded on pine barrens. In some places, such as Easton, Pennsylvania, urbanization has obliterated the original barrens.

Agricultural worthlessness and for-

In the late 20th century, pine barrens finally are being noticed—chiefly by developers eyeing them for tract housing.

bidding landscapes prompted many derisive comments about pine barrens. On Long Island, the barrens were called "the devil's land." One of George Washington's journals speaks of crossing places covered with "stunted and ill-thriven pines."

Early inhabitants soon learned to fear the pines as well. Huge wildfires set by lightning or Indians swept across thousands of acres at a time, reducing the woods to charred stumps and cinders. Houses, barns and sometimes whole towns built in pine barrens burned down. Albany and Schenectady (an Indian name which means "beyond the pine plains") repeatedly were destroyed in the 1600s by Pine Bush fires. Small wonder that until recently pine barrens were mostly left uninhabited and unnoticed except by a few independent, self-reliant residents who called themselves "pineys."

Suburban development is the pine barrens' prime destroyer. From the tiny Montague Sand Plain in northern Massachusetts to the seemingly vast pinelands of New Jersey, new roads, houses, factories, stores, power plants and all the other accoutrements



of expanding modern society are overwhelming the silent pines and the specialized creatures they shield. In the late 20th century, pine barrens finally are being noticed-but chiefly by developers eyeing them for that next block of tract housing.

Some barrens have been destroyed altogether. The North Haven Sand Plain in Connecticut now is truly barren, just an open expanse dotted with weedy aspens, cherries and brush. Its pine-barren biota was swept away first by clearing for farms, then by sand mining and finally by subdivisions. Boston obliterated its pine barrens so long ago that we will never know just how big they were. So did Burlington, Vermont. The same thing happened in the New York City boroughs of Brooklyn and Oueens, where the deceased pine barrens are memorialized by place names such as Flatbush and Flatlands.

Other pine barrens still are recognizable in spots but going fast. Almost two-thirds of the Long Island Pine Barrens, second largest after New Jersey's, has vanished beneath post-World War II Levittowns. Secondhome development has claimed twothirds of the third largest, on Cape Cod, and four-fifths of the Pocono barrens in Pennsylvania. The famous

Foresters so hated the "worthless" pine barrens that they wrote manuals on how to get rid of them.

Pine Bush, squeezed on both sides by the twin cities of Albany and Schenectady, has lost more than 80 percent of its original 25,000 acres.

Compounding habitat destruction is another problem unique to pine barrens: fire suppression. Smokey the

A female moth looking for a site to lay eggs, opposite. Buck moths pick twigs a quarter or half-inch around. Caterpillars feed on leaves of a dwarf chestnut oak. They congregate because their poisonous spines are a better defense in a mass. Black color helps them absorb sunlight for greater warmth. A female moth hangs from a branch and "calls" for a mate by releasing from the tip of her abdomen a male-attractive chemical.



Bear has been too successful. The delicate fire balance which keeps invading trees from choking the sunloving barrens vegetation has been broken. Many barrens, once subjected to one fire every 20 years or less, have not burned in 50 years or more, thanks to the diligence of local fire departments. The results are obvious. Slowly the pine barrens just fade away, becoming overgrown and eventually turning into the deciduous forests that surround them. By the time fire is restored or one gets away and opens the barrens back up, it is too late for fire-dependent buck moths and other species long since vanished.

Fire suppression has hit the most isolated barrens hardest. Large sections of the Rhode Island Pine Barrens, New York's Saratoga County Sand Belt and Maine's Shapleigh and Fryeburg pine barrens are now overrun with northern hardwood trees. In some locations, land-clearing for agriculture followed by abandonment and



At sunrise over Long Island's Dwarf Pine Plains, home of the Northeast's largest buck moth population, a male moth emerges from its pupa in fall.

regrowth under fire-free conditions has replaced pine barrens with dark, gloomy forests. The Civilian Conservation Corps of New Deal days planted white pines under the pitch pines across thousands of acres, then girdled the pitch pines, killing them. The legacy of this misconceived destruction lives on in sterile tree plantations in Glens Falls, on Martha's Vineyard and in Plymouth County and southern New Jersey. Foresters so hated the "worthless" pine barrens that they wrote manuals on how to get rid of them. One treatise is entitled, "The Pitch Pine is Dead-Long Live the White Pine!"

Although the recent past has been bleak for pine barrens, the future is not entirely hopeless. In some areas impressive land-conservation victories have been won, often by a mere

handful of naturalists and environmentalists. The most substantial victory has been in New Jersey, where after some three decades of citizen activism and lobbying the Pinelands National Reserve was created in 1980. This joint federal-state project-first of its kind in the nation-has targeted 750,000 acres for protection. About half, a core area containing a wilderness of tea-colored streams, cedar swamps and the world-famous dwarf-pine plains, is to be preserved with no development. A surrounding conservation area will remain mostly natural as well, with development strictly limited and guided into the least sensitive regions.

On Long Island, a local attempt is being made to link 33,000 acres of publicly owned pine barrens to a number of private holdings to create a 100,000-acre preserve by acquiring key areas among the governmentowned parcels. Unfortunately this effort has been hampered by squabbling among the various town, county, state and federal agencies involved and by the nationwide freeze placed on new federal land acquisition by the Reagan administration.

In New England, efforts by the Nature Conservancy Heritage Program are focusing on identifying and protecting remnant pine barrens in Massachusetts, Rhode Island, New Hampshire and Maine. In some instances this involves trying to restore fire to overgrown pine barrens in state forests and wildlife management areas.

Some of the smaller pine barrens finally are benefiting from the growing interest of nearby towns and cities where advocates have been successful in organizing pine barrens constituencies. More than a fourth of 4,000 acres left in the Albany Pine Bush have been preserved, mostly within the city limits, in a decade of intensive battling by Don Rittner and the members of the American Pine Barrens Society. Most of the rugged and scenic Shawangunk Mountain Pine Barrens has been saved through the efforts of hikers and naturalists from the nearby New York metropolitan area coupled with those of local visionaries such as the Mohonk Trust's Smiley family. But many other barrens have no champions, and unfortunately many people cannot or will not recognize the threat to the pines.

For those who must have a practical reason to save pine barrens, one miraculously has appeared: aquifer protection. All of the sandy barrens recharge pure groundwater, and in many regions drinking water is pumped from these aquifers. On Long Island, 3.5 million people obtain all of their potable water from underground. With increasing groundwater contamination by organic chemicals, salts and heavy metals in developed areas, a powerful economic argument is developing for preservation of the remaining pine barrens and the clean aquifers beneath. It remains to be seen whether this argument can develop political momentum fast enough to beat the developers. Last summer a provision protecting aquifers that are the sole source of drinking water for area residents was added to a proposed Safe Drinking Water Act



passed by the House. It failed to get out of committee in the Reagancontrolled Senate. The bill would have provided funds to acquire and preserve vital groundwater recharge areas. In the Northeast these areas are almost exclusively pine barrens.

Half of Barrens Acreage Is Gone

Listed below are the major pine barrens, their original sizes and the acreage remaining:

Name/Location	Original	Remaining
New Jersey Pine Barrens*	1,200,000	750,000
Long Island Pine Barrens (N.Y.)*	250,000	100,000
Rhode Island Pine Barrens*	30,000	1,000
Nantucket/Martha's Vineyard (Mass.)*	5,000	2,000
Cape Cod/Plymouth County (Mass.)*	150,000	50,000
Montague Sand Plain (Mass.)*	2,000	1,000
Springfield-Chicopee (Mass.)*	15,000	200
North Haven (Conn.)	1,500	0
Glens Falls Sand Plain (N.Y.)*	15,000	500
Saratoga County Sand Belt (N.Y.)	50,000	500
Albany Pine Bush (N.Y.)*	25,000	4,000
Shawangunk Mountains Pine Barrens (N.Y.)	25,000	20,000
Kittatinny Ridge Pine Barrens (N.J.)	3,000	1,000
Nottingham Serpentine Barrens (Pa.)*	5,000	1,000
"The Barrens," Centre County (Pa.)*	25,000	10,000
Pocono Pine Barrens (Pa.)*	5,000	1,000
Rome Sand Plains (N.Y.)	10,000	2,000
Plattsburgh Sand Plain (N.Y.)	5,000	500
Merrimack River Sand Plain (N.H.)	15,000	500
Ossipee Pine Barrens (N.H.)	3,000	2,500
Shapleigh Pine Barrens (Maine)*	3,000	2,000
Fryeburg Pine Barrens (Maine)*	3,000	2,000
TOTALS	1,845,500	951,700

*Pine barrens with existing buck moth populations.

All acreage estimates are approximate. Remaining acreage includes only pine barrens vegetation that has burned within the last 50 years.

The buck moth itself is starting to receive government attention, especially in the Northeast where its plight is best known. In New York and Massachusetts, where pine barrens are rapidly disappearing, the moth has been proposed for addition to state endangered species lists. The moth's status is being reviewed in other New England states. Research is starting on the condition of buck moth colonies in the deep South. Many of them have been destroyed by conversion of their habitat to croplands, pine plantations and tree farms. And in the Northeast, studies continue to assess population distribution, densities, host plant needs and habitat area requirements. Meanwhile, vital pine barrens areas are still being lost at the rate of thousands of acres per year.

It is in places such as the Albany Pine Bush that the final chapters on the fate of pine barrens will be written. I contemplated this one evening as I stopped alongside a road to pick up a dead buck moth, killed by a passing car. Rittner and I had spent the day doing a quick mark-release-recapture study, catching moths in butterfly nets and writing little numbers on their white wing bands with waterrepellent markers. Our population estimate for the Pine Bush was only 2,000 moths, so small for an insect species that the population could fail to survive. But at least it was stable, the same number as the year before and the year before that, thanks I guess to our hard-won Pine Bush preserve.

"Isn't it amazing—with the sword of doom hanging over them, they just keep flying anyway," Don said. "They don't care about aquifers, hearings, zoning or city hall. Just one thing making more buck moths for next year. I wonder what they would think of all the nonsense we go through. For what? A few lousy moths, the developers say. They'll never understand."

"You're right," I said. "But the word is getting out about pine barrens and their rare species. And as long as there are people who do understand and do care, the buck moth will keep flying next fall and every fall." \Box

John F. Cryan, entomologist and vice-president of the Long Island Pine Barrens Society, has studied buck moths for over a decade.



DEFENDERS VIEW

Stop Alaska's Wolf-Killing

by Allen E. Smith, President

HIS is not going to be a thoughtful essay on some esoteric aspect of wildlife policy or ecology. Neither is it going to be a philosophical statement about wildlife values and saving them. I do not have time or room for any of that as I write this piece. This is simply our urgent call to battle—to save the Alaska wolf from decimation by airborne killing carried out by the Alaska Department of Fish and Game in the name of "wildlife management." This is a statement from the heart—a call to action.

On December 4, 1984, the Alaska Board of Game voted 4-3 to expand the 15,400-square-mile area it already had approved for aerial wolf hunting by 4,900 square miles (see issue report on page 40).

The same simplistic logic that has nearly extirpated this magnificent predator in the Lower 48 is now at work in Alaska, our last stronghold of large naturally occurring wildlife populations and wilderness ecosystems. That "logic" is killing wolves in an attempt to increase moose and caribou herds to supply increased hunting. No decision has ever outraged me more than this stepped-up war on wolves in Alaska. This ill-conceived aerial wolf-killing decision affects not only Alaska but sets a bad example for Canada, which has often emulated Alaska on wildlife policy.

It matters not that the public testimony taken in Alaska itself over the last two years has been overwhelmingly opposed to aerial wolf-killing. It matters not that many well-respected wildlife biologists also question the biological basis for such a decision and the consequent biological ramifications of "predator control" for game purposes. It matters not that history shows us that within only two years after prohibiting airborne wolf-hunting, Minnesota found itself having to take steps to save its wolf population. It matters not that this is a plan for systematic wolf-killing that could ultimately imperil wolf survival in Alaska.

What matters is that what we are hearing about Alaska wolves is politics, not biology or real logic. What matters is that certain game managers still blindly believe in the arcane theory of single-species management manipulating wildlife populations for special purposes—and in their ability to do this with slide-rule accuracy. These slide-rule samurai have maintained the upper hand in this fierce contest of biopolitics, even in the face of negative public opinion and scientific evidence.

The Alaska Board of Game has

National Petition Drive—Alaska Wolf What You Can Do!

- Write Defenders of Wildlife for fact sheets and petitions and get them signed by as many people as you are able to. Return those petitions to Defenders so that we can deliver them to Governor William Sheffield of Alaska. Write ALASKA WOLF, Defenders of Wildlife, 1244 Nine-teenth Street, N.W., Washington, DC 20036.
- Give the membership envelope bound in this magazine to a friend. Say how important it is to join Defenders. Ask your friend to assist in the petition drive to save the Alaska wolf.



received well over 1,000 letters since this latest wolf kill began early in November-almost all of them in opposition.

It is time to act! Defenders urgently needs your help in mounting a nationwide petition drive to put pressure on the Alaska Board of Game through the office of Governor William Sheffield. We must send a loud and clear message that we oppose aerial wolf "control" in Alaska. Citizens can make a difference if enough of us band together to voice our concern. The Board of Game will be meeting in March and April. If we get enough signatures, we can influence the board's future decisions. Many Defenders members already have responded to our calls to help Alaska's wolves. Thank you! Your efforts and contributions have been extremely important. But we must do more.

The wolves of Alaska are a national treasure, not the property of Alaskan hunters and single-speciesoriented biologists. How else can it be? The wolf has been all but wiped out in the Lower 48. Will we now see this done in Alaska as well?

Join us now! Help circulate citizen petitions to get as many signatures as possible to oppose this wolf-killing. You can make a difference! \Box

A wolf makes wolf music. Photo by Jim Brandenburg. Back cover: Blue lupine provides a resting spot for a Karner Blue butterfly, one of a number of northeastern animal and plant species at risk because of depletion of once expansive pine barrens (see page 18). Blue lupine is the exclusive larval host plant for this handsome butterfly, now a candidate for federal endangered listing. Photographed in New York's Albany Pine Bush by John F. Cryan.