



Long Island Pine Barrens Society

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THE HEATH HEN

Newsletter of the
Long Island Pine Barrens Society

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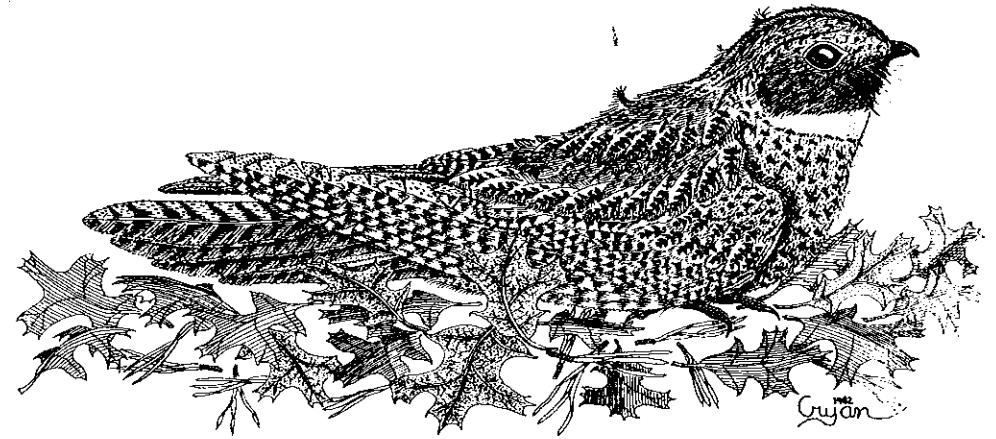
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COVER PICTURE: The Whippoorwill (*Caprimulgus vociferus*) reaches its peak breeding abundance on Long Island in the Dwarf Pine Plains, where dozens can be heard calling on still June nights. It is a nocturnal bird which feeds upon insects on the wing. During the day, Whippoorwills hide by resting quietly upon the leaf-covered ground, in the manner shown, and often will allow a person to approach to within a few feet before flying out from underfoot. The nests consist of leaf-lined depressions on the sandy ground. Whippoorwills were once fairly common over most of Long Island, especially in the Pine Barrens, but have declined precipitously in recent decades because of habitat destruction from land development. They require substantial tracts of natural land to maintain breeding populations. It is hoped that enough land in the eastern Pine Barrens can be saved to retain this magnificent bird as a resident Long Island species.

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Pine Barrens Society Publication Changes

The Long Island Pine Barrens Society now has two official publications: *The Heath Hen* and *The Thicket*. *The Heath Hen*, starting with the next volume, will be the journal of the Society, devoted to the more formal articles and notes about the Pine Barrens and other natural regions of Long Island. These contributions will contain information of a more permanent nature, and can be used as reference material on the Pine Barrens. Book reviews and essays, particularly regarding philosophy and ethics of conservation as applied to the Pine Barrens, are also welcome for *The Heath Hen*, as well as poetry and artwork on Pine Barrens or natural history-related subjects.

The Thicket is the Society's newsletter, a more informal publication containing timely information such as meeting notices and updates on current Pine Barrens conservation issues and projects, and appeals for letters and other support when needed. Pertinent information about other conservation issues of interest to Society members, and about the activities of other organizations, will also be published in *The Thicket*. Informal articles and notes, field trip accounts, and announcements are welcome for *The Thicket*.

The Heath Hen will be produced twice yearly, and *The Thicket* will come out quarterly, or four times yearly.

We hope that Society members find these two publications more useful and timely for keeping up with rapidly changing events and ideas concerning the Long Island Pine Barrens and its preservation.



The Long Island Dwarf Pine Plains:
Pygmy Forests of the Pine Barrens

by John F. Cryan

Not far from this hamlet (Riverhead) is a spot of ground about three miles in diameter, which, as I was informed by good authority, is covered with shrub oaks and pines, not more than five or six feet in height. In the whole tract there is not a single tree of the usual size, although it is surrounded by a forest of such trees.

Timothy Dwight, Travels in New England and New York, Vol. 3, p. 202, Journey to Long Island, Letter I, 1804

Of all the diverse landscapes that comprise the Long Island Pine Barrens, the most unique is that presented by the small, oval, 2500-acre region south of Riverhead known as the Long Island Dwarf Pine Plains. Timothy Dwight's comments underscore the impression this "pygmy forest" must have made on the early colonial settlers and aboriginal Americans that preceded them. For there are few places in the world where such miniature woodlands of dwarfed trees and shrubs can be found.

The Dwarf Pine Plains *is* truly dwarfed -- there are places in the center of this small region where the vegetation is barely knee-high, and throughout most of the area the stunted and gnarled Pitch Pines rarely are taller than six feet (2 m). The image one receives walking through the Dwarf Pine Plains is suggestive of an aerial view from a low-flying plane over some other Pine Barrens region. Because it is surrounded on all sides by tree-sized Pine Barrens regions, including some areas with a predomination of oak species, the low stature of the Dwarf Pine Plains is made more striking.

FACING PAGE -- A winter view of the Long Island Dwarf Pine Plains, looking south along one of the broad outwash channels left behind by the melting glacier. The Pitch Pines in this section are only 3 to 6 feet (1-2 m) tall. The Long Island Dwarf Pine Plains overlies the poorest Pine Barrens soils and is one of the most unique Pine Barrens regions, harboring hundreds of rare and endangered species.

Dwarf Pine Plains Regions

Dwarf Pine Plains vegetation, generally dominated by dwarfed Pitch Pine with an admixture of pine barrens shrubs mostly in the heath family (Ericaceae), is known in only three relatively small regions, and it is unlikely that more Dwarf Pine Plains remain undiscovered. It is ironic that two of these areas have remained unrecognized until recently (although they were sometimes mentioned in historical tracts), while the third has received worldwide acclaim and attention from the scientific community for over 200 years. This area, the famous New Jersey Dwarf Pine Plains, is located in Ocean and Burlington Counties in the heart of the 1.2 million-acre New Jersey Pine Barrens, the largest pine barrens area in the world (Long Island's is second largest). The New Jersey Dwarf Pine Plains has been divided into three sections: the so-called "West", "East", and "Spring Hill" Plains areas (see Map No. 1); they are divided by stream headwaters systems bordered by Atlantic White Cedar (*Chamaecyparis thyoides*) swamps. Together, these three areas total about 12,400 acres, making this the largest Dwarf Pine Plains region.

One of the two lesser-known regions, the Shawangunk Mountains Dwarf Pine Plains, is unique because it is situated on bedrock atop the long, narrow Shawangunk Mountain ridge. Comprising about 5,000 acres, it extends from Sam's Point on the south to the vicinity of Lake Awosting in Ulster County, southeast of the Catskills. Because it is located farther north than its sister Dwarf Pine Plains areas, and at much greater elevations (maximum; 2250 feet), the Shawangunk Mountains Dwarf Pine Plains contains many northern plants and animals not found in the other two areas. Rhodora (*Rhododendron canadense*), one of the most beautiful and rare native azaleas, is found abundantly in the Shawangunk Dwarf Pine Plains, its masses of showy, fragrant pink flowers opening in late May. Broom Crowberry (*Corema conradii*), a prostrate, evergreen subshrub, grows in one small area in the Shawangunks and reaches its southern limit in the New Jersey Pine Barrens. Curiously, although it is also abundant on Cape Cod, this tiny northern plant has never been recorded from Long Island.

The Long Island Dwarf Pine Plains is the smallest of these three "pygmy forests", and it is also the most vulnerable to damage or destruction by human activities. Each of the three Dwarf Pine Plains regions (New Jersey, Shawangunks, and Long

Island) is distinct and easily separable from the others because each contains distinct dominant plant species and, although they share the dwarf Pitch Pine in common, each region has its own vegetation structure. In New Jersey, dwarf pine is codominant with Blackjack Oak (*Quercus marilandica*), which grows as a scraggly shrub or small tree. Scrub Oak (*Q. ilicifolia*) is much less important here than on Long Island, and the understory includes plants not found in the other two Dwarf Pine Plains regions such as Pyxie (*Pyxidanthera barbulata*) and Sand Myrtle (*Leiophyllum buxifolium*). In the Shawangunks, dwarf pine shares dominance with many heath family members, including Black Huckleberry (*Gaylussacia baccata*), Late Lowbush Blueberry (*Vaccinium vacillans*), Rhodora, and in low pockets in the bedrock, with Leatherleaf (*Chamaedaphne calyculata*) and Sheep Laurel (*Kalmia angustifolium*). Scrub Oak and the other dwarf oaks normally found in pine barrens areas are very rare in the Shawangunks because of the elevation and northern climate.

Vegetation of the Long Island Dwarf Pine Plains

In Long Island's Dwarf Pine Plains, dwarf pine and Scrub Oak share dominance equally; about 50% of the tall shrub layer, the highest of three distinct plant strata, is composed of each. The height of this layer is also the height of the Dwarf Pine Plains -- usually under six feet (2 m). Beneath the tall shrub layer is a low shrub layer composed almost exclusively of Black Huckleberry and Late Lowbush Blueberry. Other plants in the heath family are occasionally seen here, also, such as Black Chokeberry (*Aronia melanocarpa*), Early Lowbush Blueberry (*Vaccinium angustifolium*), and Sheep Laurel. Underneath these two shrub layer is still a third shrub layer, composed mostly of the ground-hugging heaths, Bearberry (*Arctostaphylos uva-ursi*) and Wintergreen (*Gaultheria procumbens*). Sweetfern (*Comptonia peregrina*) and Pine Barrens and Beach Heather (*Hudsonia ericoides* and *tomentosa*) grow in sunny openings in the second, or low shrub layer, which averages about 12 to 18 inches in height (the ground-hugging shrubs are only a few inches tall). Most of the wildflowers, grasses, and other herbaceous plants are also found in rather open places among the dwarf pines, Scrub Oaks and heath shrubs. Over 95% of the biomass in the Dwarf Pine Plains is composed of the woody plants named above, while the several hundred other native plant species comprise the rest. The pattern is one of complete dominance, both ecologically and visually, by

about seven woody plant species, with the vast majority of other species present as scattered clumps or individuals. In this respect, as in many others, the vegetation of the Dwarf Pine Plains represents an extreme when compared with the vegetation of the rest of the Pine Barrens or other areas on Long Island.

In the Pine Barrens and indeed all other areas with natural vegetation, changes in plant and animal species presence, composition, and abundance tend to occur gradually over long distances and tend to correspond to gradual changes which occur in other natural features such as soil properties, proximity to surface or underground water, local climatic conditions such as humidity, wind speed, or rainfall, and the presence, absence, and competitive effects of other plant and animal species. A line of gradual change in vegetation is called a *gradient*. In the Long Island Pine Barrens, many gradients occur among upland and wetland areas, between the edges of the Pine Barrens and surrounding vegetation formations, and between adjacent subregions within the Pine Barrens. The major gradient of change, however, parallels the orientation of the island and runs in a west-to-east direction. Along this gradient, changes occur from the Hempstead Plains prairie to the low thickets of the Oak Brush Plains, to the denser Pitch Pine stands of the central area of the outwash plain south of the central Ronkonkoma Moraine, through pine-oak woodlands located on the moraine and especially well-developed in the Manorville and Riverhead Hills, to the stunted, thick pine stands in the transition zone surrounding the Dwarf Pine Plains, and finally to the dwarfed "pygmy forest" itself.

It is clear from even a cursory look at the Dwarf Pine Plains that it represents the extreme endpoint of a continuum of Pine Barrens vegetation types. It contains the most stunted plants -- not just the dwarf pines but all the other species present are dwarfed to some extent compared to populations elsewhere. The "root to shoot" ratio, or proportion of a plant's weight above ground compared to its weight below ground, of all Dwarf Pine Plains species is very low; in other words, most (in some cases over 90%) of the biomass of each plant species is below ground, in the form of massively-developed root systems. Above ground, the stems and twigs of most species are shortened and thickened, the distances between leaves (called internodes) are shortened, and the

leaves are smaller, thicker, narrower, or covered with more waxy secretions than those of individuals growing in other Pine Barrens subregions. Many of the animal species living in the Dwarf Pine Plains, particularly the less mobile forms such as the reptiles or insects, have dwarfed individuals as well; when compared with those of "normal" or average sizes outside. It is clear that the organisms here are living under extremely harsh and stressful conditions, even when compared with the vicissitudes of Pine Barrens existence in surrounding areas. What has caused or is causing the dwarfing of so many diverse creatures here? Why is the vegetation structure so different from other Pine Barrens areas? What is causing so few plant species to dominate the region, while the rest are fugitives or widely scattered, and why does the species diversity of Dwarf Pine Plains plants appear so relatively low while insect diversity seems so great? Why do a number of species reach their greatest abundances or densities island-wide or even range-wide here, in such a seemingly adverse environment? An examination of the two major natural forces that shape and maintain Pine Barrens ecosystems and how they differ in the Dwarf Pine Plains will provide part of the answers.

Harsh Soils and Frequent Wildfires: Creators of the Dwarf Pine Plains

The most likely cause of dwarfing in plants is poor soil conditions, and upon closer inspection than Timothy Dwight was able to do it becomes clear that the soils underlying the Dwarf Pine Plains are, with the possible exception of dune or beach sands (although these receive nutrient input from salt spray, a source not available in the Dwarf Pine Plains), the most nutrient-poor and drought prone on Long Island, and indeed along the east coast. They are also among the most acidic soils anywhere, with pH readings as low as 3.2 in some places. Dwarf Pine Plains soils consist almost entirely of quartz sand and gravel, bleached where exposed to sunlight to a brilliant white, and overlain by three narrow bands where some organic material is present: a yellowish zone of deposition about 3 to 12 inches down, a dirty grey zone of leaching about one to three inches down, and a thin, brownish mixture of organic debris and sand at the top inch. Overlying this is a layer of largely dried but undecomposed leaf and twig litter which varies from place to place in thickness depending on the length of time since the last wildfire. This description may be recognized by soil scientists as that of a *podzolic*

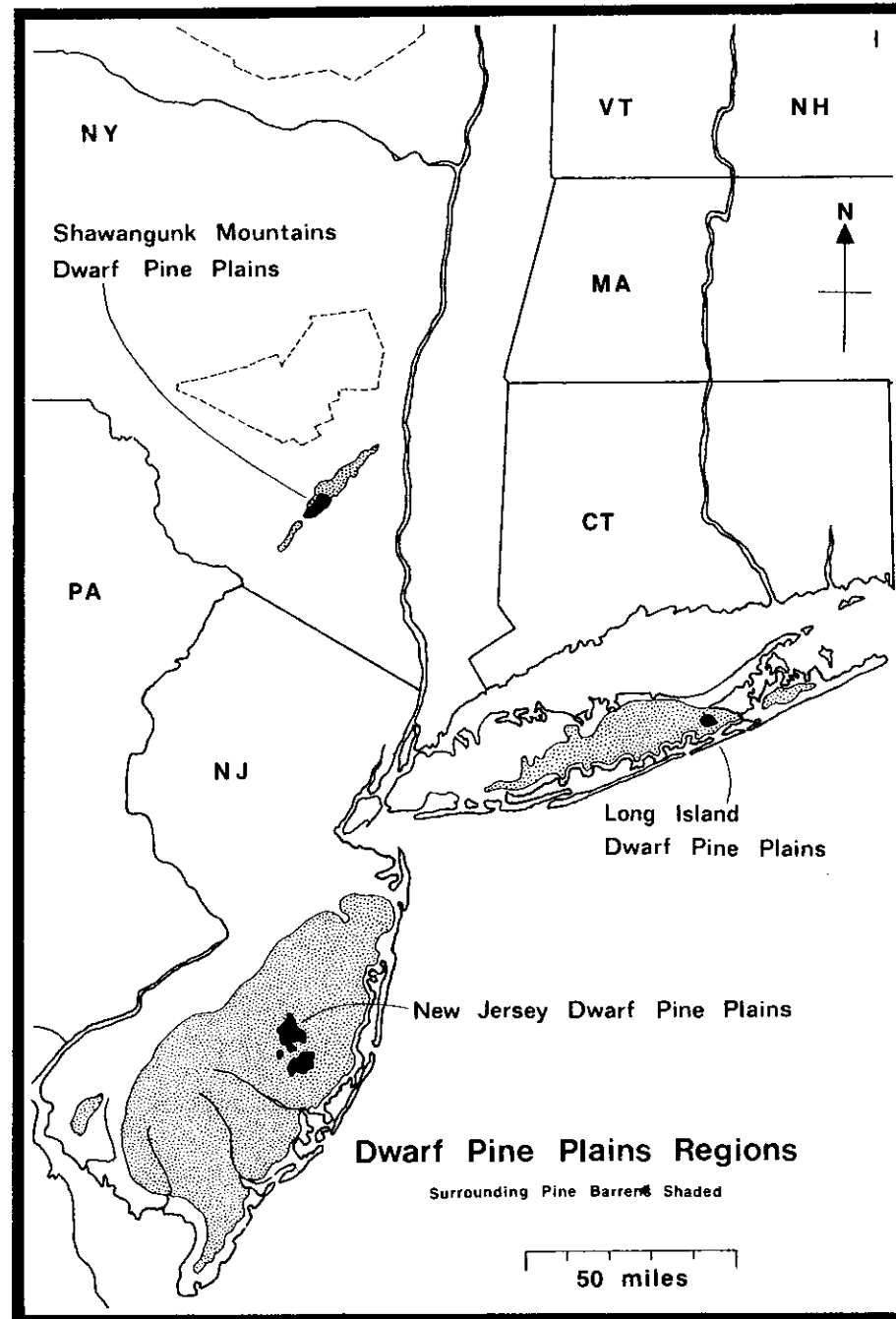
soil, one characterized by acidity, light texture (usually sandy), and the presence of a zone where almost all of the nutrients have leached through from the organic layer above to the inorganic basement sands and gravels below. Such soils are characteristic and widespread in northerly regions possessing cool, rainy climates, like the Adirondack Mountains and large areas of Canada. Farther south, podzolic soils recur on the sand deltas of major river valleys and along the northeastern Atlantic coastal plain, where they are usually covered by Pine Barrens vegetation. The distribution of such regions as the Cape Cod, Long Island, and New Jersey Pine Barrens, and inland ones like the Albany Pine Bush, Montague Sand Plain (MA), and the Centre County (PA) Barrens closely parallels that of podzolic soils. Dwarf Pine Plains soil, then, is an extreme form of podzol which is more acidic, droughty, and nutrient-poor than the typical versions underlying other Pine Barrens areas. It follows that the most harsh and limiting soils in this part of the east should support rather unusual vegetation and faunation adapted to them, and the Dwarf Pine Plains is that community -- a group of interacting species which are the only ones capable of overcoming the severe soil conditions. To use an analogy, if Pine Barrens communities in general are special woodlands adapted to natural conditions (poor soils, frequent wildfires) which prevent the existence of the regionally dominant northeastern mixed mesophytic or deciduous forests, then Dwarf Pine Plains communities are special "pygmy forests" adapted to natural conditions so severe that they prevent even the existence of the locally dominant Pine Barrens woodlands.

Throughout most of the Long Island Dwarf Pine Plains, the water table is located out of reach of plant roots, at depths below the surface of 40 or more feet in places. The porous sandy soils quickly gobble up any rainfall which is not transpired or evaporated and returned to the atmosphere. At the surface, then, the soil is very dry and tinder-like most of the time. This droughtiness is the major cause of the very high frequencies of natural wildfires in the Dwarf Pine Plains. While many areas in the Pine Barrens have an average of one fire every 15 to 25 years, the Dwarf Pine Plains naturally burns at an average of one fire every six years, the highest frequency in the region. Rapid fire cycling in the Dwarf Pine Plains exerts a powerful selective force on the plants and animals that live there, a force whose effects are most striking in the many adaptations of the dwarf pines themselves.

Many of the plants are dwarfed because this is the only growth form that enables them to survive the triple threat of the driest, most nutrient-poor, and most fire-prone Pine Barrens region. It is most advantageous for the relatively few woody plant species that thrive in the hostile environment of the Dwarf Pine Plains to devote their above-ground biomass to rapid and prolific fruit production because the extremely frequent burns regularly destroy their above-ground growth, and because nutrient limitations preclude the development of massive above-ground plant structures anyway. Even many plants considered "pine barrens species" are unable to cope with the limitations posed by these severe conditions, and so they drop out somewhere along the gradients leading from more favorable Pine Barrens regions to the "core" of the Dwarf Pine Plains. The exaggerated soil and fire characteristics of the Dwarf Pine Plains have similar effects on most of the vertebrate animal groups, causing drops in species diversity as one approaches the Dwarf Pine Plains. These lowered diversity levels result in less predation and competition among the animal species that can tolerate the searing, fire-swept landscape of the Dwarf Pine Plains, providing some of them ideal survival opportunities. This partly explains why many specialized pine barrens species reach greatest abundances in this relatively tiny, 2500-acre region. Dwarf Pine Plains insects, however, are an exception to this trend -- their diversity increases toward the "core" dwarfed area, and there are hundreds of species which occur nowhere else on Long Island except the Dwarf Pine Plains. The short generation times of many insects (usually less than a year), their low resource needs, and great adaptability may explain the existence of so many rare and local species of insects in the stressful environs of the Dwarf Pine Plains.

Dwarf Pitch Pine and its Significance

The most famous species in the Long Island Dwarf Pine Plains is the dwarf pine itself. This pygmy form of the dominant Pine Barrens tree, Pitch Pine, possesses many remarkable adaptations which make it uniquely fitted for life under some of the harshest soil and fire conditions in North America. The most obvious of these is its reduced, shrublike growth form, with multiple stems, short twigs and needles, and massive root systems. Dwarf pines average between four and six feet in height, and some have leaders which reach to ten feet. The dwarf pine has obviously evolved



under the twin stresses of very nutrient-poor soils and very frequent wildfires, and it is likely that these severe conditions (and also soil droughtiness) were even worse in the Dwarf Pine Plains region 10,000 or more years ago, when Pitch Pine reached Long Island following glacial retreat. During this period, the Xerothermic Interval (sometimes called the Hypisthermal Interval), the postglacial climate of Long Island reached a peak in warmth and probably dryness. The dwarf form of Pitch Pine most likely developed under these warmer and drier conditions, and the area of the Long Island Dwarf Pine Plains was undoubtedly larger than it is at present. Because large areas of the Atlantic coastal plain, now under water, were exposed in postglacial time until the rising sea covered them, there were much larger acreages of Long Island outwash plains available for plant colonization. The Pine Barrens extended far seaward of its present southern boundaries, and may for a short while have been twice or more times its present 250,000-acre size. For a while, the pine barrens regions of New Jersey and Long Island were linked by this larger coastal plain. There is some speculation that the present-day Dwarf Pine Plains of the New Jersey and Long Island Pine Barrens are but scattered marginal remnants of a larger band or series of dwarf pine-dominated vegetation that inhabited the now drowned part of the coastal plain, and which were derived from a single dwarf pine stock. Others hold that the dwarf Pitch Pines in each of the three known Dwarf Pine Plains regions evolved independently as a result of relatively frequently occurring genetic mutations for the dwarf pine characteristics, coupled with strong, similar selection pressures in each region.

FACING PAGE -- The map shows the locations of the only three known Dwarf Pine Plains regions in the world. The New Jersey Dwarf Pine Plains, split into three sections, is the largest of the three regions, totalling about 17,000 acres. The Shawangunk Mountains Dwarf Pine Plains, only recently recognized by scientists, covers over 6,000 acres in the Sam's Point region of the Shawangunk Mountain ridge, near Ellenville, New York. The Long Island Dwarf Pine Plains is the smallest of the three areas, covering only 2,500 acres originally. It is also by far the most threatened of the three Dwarf Pine Plains regions. Each Dwarf Pine Plains region is distinct and has its own unique biota. The three areas are tied by having Dwarf Pitch Pine, frequent fires, and acidic, nutrient-poor, arid soils in common.

Among the most-noticed features of dwarf Pitch Pines are their possession of serotinous, or closed, cones. These do not open every year in the fall, the way normal pine cones do, but stay tightly sealed shut until a passing wildfire opens them and releases the seed. Some serotinous cones can persist closed for several decades, the seed inside remaining dormant and viable.

Only a handful of pine species (like Jack Pine, *Pinus banksiana*) possess serotinous cones, and in these species, all the trees have them. Pitch Pine is unique because its populations contain individuals which have closed, or serotinous, and the normal open cones, in varying proportions of trees (individual trees can only have all open or all closed cones; there are no mixed trees). Cone serotiny has been shown to be genetically-based, with open cones being dominant and closed recessive. To produce closed cones, then, a Pitch Pine must possess two genes for this condition, one from each parent. It is obvious that very strong natural selection would be necessary to create and maintain a Pitch Pine population with all or nearly all closed-coned trees, yet this is exactly what has happened in the Dwarf Pine Plains. It is the only Long Island Pine Barrens region where one can find 100% serotinous-coned trees, and the average serotiny level of the "core" area exceeds 95%. The dwarf form of Pitch Pine not only produces mostly or all closed cones; it produces a lot of them. The proportion of cone weight to tree weight is over ten times greater in dwarf as in normal-sized Pitch Pines. Individual dwarf pines sometimes have hundreds of cones on them, their branches sagging downward under the weight. Of course, some of this cone proliferation is caused by many years' worth of closed cones remaining on the dwarf trees, but serotinous dwarf pines do produce many times more cones per year than non-serotinous ones or tree-sized pines.

Like the dwarfed stature, the possession of closed cones and their luxuriant production reflect the very harsh physical conditions of the Dwarf Pine Plains, and are characteristics which make the dwarf pine well-adapted for its role as the dominant organism of the region. The combination of frequent wildfires (one per six years on average) and the driest, poorest, and most acidic soils in the Pine Barrens are successfully overcome by the dwarf pine's low, nutrient- and water-saving growth form, early and prolific fruiting,

and production of serotinous cones which protect the seed from fires, yet also release them all at the most opportune times for growth, when an open, sunlit, ashy seedbed has been created.

Around the 2500-acre "core" of the Dwarf Pine Plains is an even larger transition zone, where pine height increases fairly rapidly from 3 to 6 feet (1-2 m) to about 20 to 25 feet (6-8 m). Beyond this doughnut-shaped area (which is about 100 to 500 yards wide) is another, secondary, zone of dwarfing effects. The Pitch Pines here are tree-sized, but are quite short (only 25 feet maximum) at maturity, and grow in close, gloomy ranks, presiding over a dense, impenetrable Scrub Oak thicket. This "secondary transition zone" rings the first one and the core area of the Dwarf Pine Plains, and ranges in width from less than a mile to the south and north, to several miles to the east and about eight miles to the west of the core area (see map no. 2). Together, the two transition zones, or areas of partial Pitch Pine dwarfing, cover over 10,000 acres.

At the edges of the low, central "core" region of the Dwarf Pine Plains, there are transition zone trees of 10 to 20 feet growing as outliers within the lower 4 to 6 foot tall dwarf pines. This invasion of single-stemmed, small tree-sized Pitch Pines is happening all around the margins of the most dwarfed region, and is apparently natural. It indicates that because of climatic cooling, the Dwarf Pine Plains is slowly but gradually shrinking, and that this unique region was once far larger than it now is. The Pitch Pines in the two transition zones possess characteristics intermediate between dwarfed and full-sized pines, with those closer to the "core" showing greater amounts of dwarf pine features (like greater cone serotiny, lower height, and greater tendencies toward multiple stems and branches skirting the ground). It is obvious that these intermediate pines contain some genetic material from both tall and dwarf trees, and that the two types of Pitch Pines interact to produce offspring only or mostly in the transition area. This phenomenon of two genetically distinct populations producing a gradient of hybrid or intergrade individuals between them is known as *introgression*. It is mostly observed between two closely related species. Studies are now underway to clarify the taxonomic status of the dwarf Pitch Pine, which has never been given a formal scientific name as a

distinct species, subspecies, or form. It now seems likely that it will be designated as a subspecies of Pitch Pine.

Some Plants and Animals of the Dwarf Pine Plains

While the vegetation of the Dwarf Pine Plains is dominated by only seven hardy Pine Barrens woody plant species (dwarf Pitch Pine, Scrub Oak, Black Huckleberry, Early and Late Lowbush Blueberries, Wintergreen, and Bearberry), the region's flora is much richer and more diverse. Many of the less common woody plants are embedded, in small clumps, within the waist-high pygmy forest; and most of the several hundred herbaceous plant species found here are strongly seasonal, blooming and fruiting rapidly and often disappearing above ground entirely in a few weeks. All of them are Pine Barrens or Atlantic Coastal Plain endemics, and many of them reach peaks in abundance regionally or rangewide in their Dwarf Pine Plains haunts.

Among the shrubs are found smaller woody plants. Sweet-fern (*Comptonia peregrina*), which has fernlike leaves, gives off a spicy aroma which mingles with those of many other Pine Barrens species to give the Dwarf Pine Plains its distinct fragrance. Pine Barrens Heather (*Hudsonia ericoides*) invades sandy, disturbed areas with many herbs. It blooms in May and early June, the plants becoming covered with yellow five-petaled flowers. Dwarf Sand Cherry (*Prunus pumila*), which also flowers in early spring and is restricted to dry soils, is found at the edges of clumps of Scrub Oak. Plants of this small, rare relative of the ubiquitous Black Cherry rarely exceed two feet in height.

Many rare Pine Barrens herbs and wildflowers can be found in the Dwarf Pine Plains, but most of them grow, flower, set seed, and die out in only one season or a few months, so one must search for them at the proper season. At any given time, the Dwarf Pine Plains may appear to be very poor in wildflowers, but the species diversity here is actually greater than that of most upland Pine Barrens areas. This is presumably because the low stature of the Dwarf Pine Plains allows full sunlight, a requirement of most Pine Barrens species, to reach the lower plant layers.

Most of the herbaceous plant species of the Dwarf Pine Plains are found elsewhere in at least some other parts of

the Pine Barrens, but many of them reach peak abundances or densities in the Dwarf Pine Plains. Also, most plant species populations in the Dwarf Pine Plains differ substantially in appearance, structure, and biology from populations found elsewhere. Generally, Dwarf Pine Plains wildflowers are smaller than usual and have smaller flowers. They tend to flower later than their relatives in surrounding regions, and produce less and larger seeds than outside populations. Some of these differences may be caused by the harsh environment of the Dwarf Pine Plains, but some are undoubtedly genetically based, the results of adaptations for life there. Most of these plant populations have not been studied, and even the best-known Dwarf Pine Plains plant, the dwarf Pitch Pine itself, presents many unsolved mysteries about environmentally-induced as opposed to genetically-based, characteristics.

Fire Sedge (*Carex pensilvanica*) is a small, grasslike sedge which covers newly-burned soil in the Pine Barrens. It is very abundant in disturbed areas or in sunny, open spaces between shrubs. Likewise Orangegrass (*Hypericum gentianoides*), not a grass but the smallest St. Johnswort species, prefers sunny, sandy openings; if picked, the stems and tiny, scale-like leaves (adapted for water conservation) smell like fresh oranges. Its tiny yellow flowers open only in the full July sun.

Many other small herbs grow in the natural clearings between Dwarf Pine Plains shrubs. Blue Curls (*Trichostema dichotomum*) is a tiny plant which is covered in late summer with dark purplish-blue, tubular flowers with long curved stamens. Large Partridge-pea or Wild Sensitive Plant (*Cassia splendens*) has mimosa-like leaves which fold if disturbed. It prefers slightly more sheltered areas under the dwarf pines and Scrub Oaks. Sandwort (*Arenaria groenlandica*) and Sand Spurrey (*Spergularia rubra*) both are tiny, ground-hugging plants that produce many small, white, five-petaled flowers in midsummer. They, along with many of the smaller herbs, are found on bare sand in newly burned or disturbed areas, or in the "heaths", parts of the Dwarf Pine Plains that were cleared during World War II and are now slowly recovering through plant succession. Birdfoot Violet (*Viola pedata*), although not as abundant as in the Oak Brush Plains to the west, still is found in fair numbers in the Dwarf Pine Plains, blooming in May with other

coastal plain violets like Britton's Violet (*Viola brittoniana*) and Palmate-leaved Violet (*Viola palmata*). Coast Jointweed (*Polygonella articulata*), a slender, colonial plant with masses of small, pinkish-white flowers, appears in late summer and early fall, after many of the other wildflowers have died back.

Five species of Bush Peas or Bush Clovers (*Lespedeza*) bloom in midsummer in sunny openings among the Scrub Oaks. These plants, which are semi-woody and often reach two or three feet in height, are topped by dense heads of pink or white flowers. The two commonest Aster species in the Dwarf Pine Plains are also semi-woody and well-adapted against the droughty soils. Stiff-leaved Aster (*Aster linariifolius*) has leaves resembling those of Pitch Pine -- narrow and stiff. Rough-leaved Aster (*Aster rugosus*) has sandpapery, tough leaves coated with a thick epidermis. Both have lavender flowers and bloom in fall.

The Dwarf Pine Plains is home to several species of Frostweeds, one of which is on the federal endangered plant list. Four species of Frostweeds are native to Long Island (*Helianthemum canadense*, *dumosum*, *propinquum*, and *bicknelli*); the first two are found in the Dwarf Pine Plains. Further searching is needed to determine if the other two may occur there also; the third Frostweed species is known from the Hempstead Plains.

The Dwarf Pine Plains is the best place on Long Island, with the exception of a few Atlantic barrier beach areas, to see ground- and tree-covering lichens in all their primeval magnificence. The lichen flora, which includes over one third of Long Island's 300 species, is so impressive there because of the open, tundra-like conditions and the lack of air pollution due to little development and generally windy conditions in the Dwarf Pine Plains. The Reindeer Lichens, light whitish green and multiply-branched, are the most conspicuous group. They include *Cladina submitis*, *subtenuus*, *boryi*, *mitis*, and *alpestris*, the latter being known as Alpine Reindeer Lichen and a very rare species on Long Island. More than twenty species of the genus *Cladonia*, including the bright red British Soldiers (*Cladonia cristatella*), are found mixed in with the Reindeer Lichens. Another are species, Iceland Moss (*Cetraria arenaria*), is found south to Long Island and reaches peak abundance in the

Dwarf Pine Plains because it resembles its preferred tundra habitats. Other widespread Dwarf Pine Plains lichens include *Parmelia rufecta*, *perforata*, *saxatilis*, and *caperata*, *Pycnothelia papillaria*, *Peltigera canina spuria*, and *Parmeliopsis placorodia* and *aleurites*.

Despite its dryness most of the year, the Dwarf Pine Plains supports a rich and unusual fungus flora containing many rare or little-known species, especially mushrooms. Many Amanita Mushrooms (*Amanita inaurata*, *cokeri*, *citrina*, and *muscaria*) and Boletes (*Boletes badius*, *satanas*, and *luridus*) appear after heavy rains, along with such interesting genera as *Tricholoma*, *Agaricus*, and *Suillus lutens*. Bird's Nest Fungi, especially *Cyathus striatus*, can be found fruiting on dead wood, their cup-shaped fruits filled with spore-containing "eggs" that are propelled great distances by the force of falling water drops. Puffballs (especially *Scleroderma*) are found where wood is buried under the sand, and Earthstars (*Geastrum*) can be seen everywhere; they are modified puffballs with an outer skin that opens in a star-shaped pattern and enables the fruit to be blown around like a tumbleweed, dispersing the spores. Earthstars are restricted to dry sandy soils.

Like the plants, there are many species of Pine Barrens which reach maximum abundances or have their only Long Island populations in the Long Island Dwarf Pine Plains. The reasons for this are as diverse as those of the plants -- less competition due to nutrient, drought, or fire stresses, specialized adaptations to overcome these harsh conditions, and the low, open, sunny vegetation structure are a few that we understand. Many of the causes for the remarkable insect abundance and concentration of endemic or isolated populations in the Dwarf Pine Plains are very poorly understood.

Among Dwarf Pine Plains breeding birds are many species which occur throughout the Pine Barrens, but find the Dwarf Pine Plains to their liking. The Black-and-White Warbler is often seen among the dwarf pines, and the Prairie Warbler reaches its greatest breeding density on Long Island there; hundreds of calling territorial males can be heard in June. The uncommon Black-throated Green

Warbler also regularly breeds in the Dwarf Pine Plains. Two very common Pine Barrens birds, the Eastern Towhee and Brown Thrasher, spend most of their time in and among the low shrubs, and many sparrow species, including Field, Chipping, and Song Sparrows, nest in the Scrub Oaks or dwarf pines also. Ruffed Grouse, which are declining on Long Island due to habitat destruction, still breed in numbers in the Dwarf Pine Plains. Sparrow Hawks can be seen perched on dead spars or hunting insects, and a surprising resident species, the Marsh Hawk, usually found along the beaches and salt marshes, is regularly seen there year-round and may breed in the region. Nocturnal birds common in the Dwarf Pine Plains include the Screech Owl, the northern Saw-whet Owl (also suspected to breed in the Dwarf Pine Plains), and the Long-eared Owl, once common but now rare on Long Island. Nighthawks can be seen and heard in the spring and fall, and the Whippoorwill has its greatest breeding concentration in the region; dozens can be heard on a quiet June night. Chuck-wills-Widow, a southern relative of the Whippoorwill, has been seen in the Dwarf Pine Plains and may breed there; it is expanding its range northward.

Relatively few mammals inhabit the Dwarf Pine Plains because of the extreme conditions. Among the commonest are the White-tailed Deer, which find much to eat in the abundant berry and seed crops, and Red Fox, which dens under the roots of large dwarf pines. Many smaller mammals, including the Meadow Vole, Pine Vole, Deer Mouse, White-footed Mouse, Woodland Jumping Mouse, Masked Shrew, and Eastern Mole, inhabit the ground and subterranean levels, feeding mostly on the abundant insect life there. The Grey Fox once occurred in the Dwarf Pine Plains (and in the Hempstead Plains and the Pine Barrens was the commoner fox species), but has disappeared from most of Long Island because it cannot tolerate human disturbance.

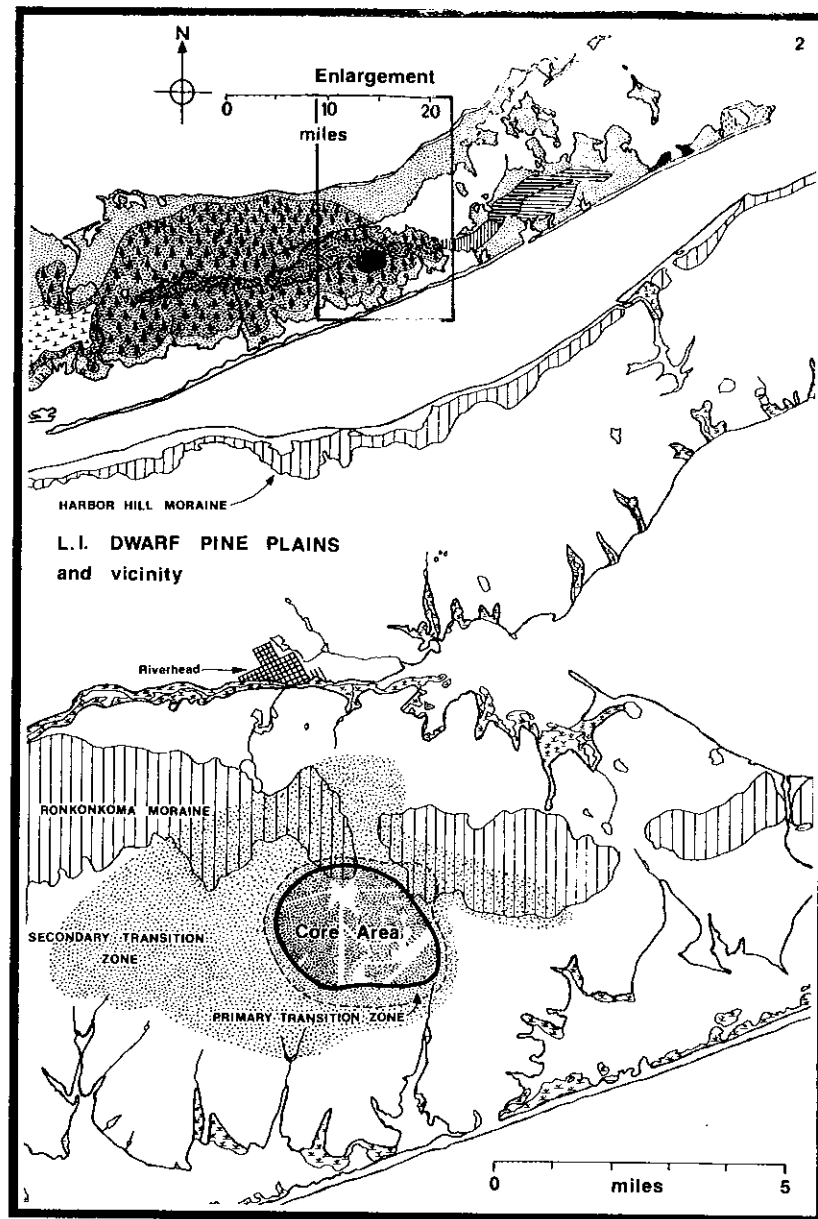
Likewise few reptiles and amphibians exist or can be regularly found on the hot, dry Dwarf Pine Plains sands. The Fowlers Toad and Lead-backed Salamander are the only two recorded amphibians, and they both are much more sparsely distributed than usual. Several snake species, including the Smooth Green Snake, which eats insects, and the Hognose Snake, are occasionally found there, but the hot, dry conditions preclude large

breeding populations of most reptile species also. An individual or two can be found wandering through the area, but it is clear that the Dwarf Pine Plains is an unfavorable microhabitat for most native reptiles and amphibians.

The insects, most numerous group in any terrestrial ecosystem, are one of the showcase groups of Dwarf Pine Plains organisms. Several hundred insect species have been recorded here and nowhere else on Long Island; hundreds more are endemic Pine Barrens species with their greatest densities or largest populations in the Dwarf Pine Plains. This mostly unexplained concentration of rare and local species in the Dwarf Pine Plains makes it a reservoir of obscure and seldomly seen life forms which must be preserved to maintain the natural diversity of Long Island.

The butterfly fauna includes most of the coastal plain and Pine Barrens species found elsewhere on Long Island, as well as some very local and declining ones. Horaces and Juvenals Dusky Wing Skippers (*Erynnis horatius* and *juvenalis*) are found in the early spring, along with the Scrub Oak-feeding Sleepy Dusky Wing (*Erynnis brizo*). These camouflaged brown insects are associated with Pine Barrens oaks and prefer hot and dry conditions. The Cobweb and Dusted Skippers (*Hesperia metea* and *Atrytonopsis hianna*) also fly in early spring and depend on Bluestem grasses for their existence. The Hoary-edge Skipper (*Achilaxus lycidas*), dark brown with white-edged hindwings, depends on Bush Peas for survival. Leonard's Skipper (*Hesperia leonardus*), a bright gold color, flies late in the summer and also feeds on grasses. Cloudy Wing Skippers (*Thorybes pylades* and *bathyllus*), black with small transparent white dots, fly in midsummer and can be seen at many Dwarf Pine Plains wildflowers.

Four species of Elfin Butterflies (Pine, Brown, Frosted, and Hoary: *Incisalia nippon*, *augustinus*, *irus*, and *polios*) fly very early in spring in the Dwarf Pine Plains, and all are restricted to Pine Barrens regions because they depend solely on Pine Barrens plants for food -- the Pine Elfin on Pitch Pine, Brown on Blueberry, Frosted on Wild Inaigo, and Hoary on Bearberry. A related group, the Hairstreak butterflies, includes many



rare Dwarf Pine Plains inhabitants. Edward's Hairstreak, which appears in July, feeds only on Scrub Oak as a caterpillar. The Grey Hairstreak depends solely on Bush Clovers. And the Northern Hairstreak (*Strymon edwardsii*, *melinus*, and *ontario*, respectively) is very uncommon on Long Island but evidently favors the Dwarf Pine Plains because of its low, open vegetation.

The Little Sulfur (*Eurema lisa*) is not a resident of Long Island but migrates northward in numbers certain years. It breeds in the Dwarf Pine Plains, feeding on Wild Sensitive Plant. And the beautiful orange and brown Regal Fritillary, dependent on Birdsfoot Violet, has become almost extinct on Long Island but still is sometimes seen in the Dwarf Pine Plains (*Speyeria idalia*).

The Dwarf Pine Plains moth fauna is among the most diverse in the Long Island Pine Barrens, and contains many species not found elsewhere on Long Island. Three Underwing Moths, with camouflaged front wings and bright red or yellow hind wings (*Catocala similis*, *jair*, and *herodias gerhardi*), are found in few other places in the northeast. Three Sphinx Moth species are particularly abundant in the Dwarf Pine Plains: the Pine Sphinx (*Lapara coniferarum* and *bombycoides*), the Cherry Sphinx (*Sphinx drupiferarum*), and the beautiful White-lined Sphinx (*Celerio lineata*). The tiny, day-flying Blueberry Clearwing Sphinx (*Hemaris diffinis*) reaches peak Long Island abundance in the Dwarf Pine Plains. The Blueberry Tiger Moth (*Apantesis persephone*) is black with bright yellow stripes and pink hindwings; it is very rare, but abundant in the Dwarf Pine Plains. The wool-textured Flannel Moth (*Lagoa*

FACING PAGE -- The map shows the regional location of the Long Island Dwarf Pine Plains and an enlargement of the immediate Dwarf Pine Plains "core" area, where the trees are under six feet (2 m) tall. Also shown are disturbed areas within the Dwarf Pine Plains and the approximate boundaries of the two concentric "transition zones" which surround the "core" area. The transition zones are areas of similar soils which show genetic introgression from the pure Dwarf Pine Plains "core" area; about 8,000 years ago, when the climate reached a post-glacial peak in warmth and dryness, the "core" area may have covered the entire transition zones. All boundary lines are approximations of the centers of smooth gradients from core area to transition zones.

crispata) depends on a small Blackberry for food. Feeding on two species of upland willows found in the Dwarf Pine Plains is the Lappet Moth (*Tolyte laricis*), which flies in September. Three species of Oakworm Moths (*Anisota stigma*, *senatoria*, and *virginiensis*) depend on Scrub Oak for food and occur in the Dwarf Pine Plains; two are very rare on Long Island. A moth group containing many rarities is the Winter Moths (tribe Lithophanini, family Noctuidae), which emerge in fall, and hibernate as adult moths, flying again in early spring; many species are known only from the Dwarf Pine Plains on Long Island.

Many other Pine Barrens insect groups reach maximum abundance or diversity in the Dwarf Pine Plains. The Tiger Beetles (*Cicindella*), fierce diurnal predators often seen on bare sand, are represented by ten species. The related Bombardier Beetles (*Brachinus*) can shoot a debilitating chemical several inches if disturbed; they are found beneath woody debris. The Pine Elater (*Alaus myops*), a close relative of the commoner Eyed Elater, feeds only on the wood of dead Pitch Pines and is common in the Dwarf Pine Plains but rare elsewhere. Many fly families, including the Bee Flies, Hover Flies, and Robber Flies (families Bombyllidae, Syrphidae, and Asilidae, respectively), are represented by dozens of specialized species adapted for life in hot, dry microclimates. Sand Wasps (Sphecidae) and Solitary Bees (apidae) nest in the open sands. Bright red and black Velvet Ants (Mutillidae) likewise make underground nests. Many species of bright yellow and orange-winged Banded Grasshoppers (Oediponinae) can be observed flying up from underfoot. And there are hundreds of parasitic flies and wasps (Ichneumonidae, Braconidae, and Tachinidae) which are specialized to attack the specialized Dwarf Pine Plains insects mentioned above.

The Buck Moth in the Dwarf Pine Plains

The Buck Moth is one of the most visible and abundant animal species at the Dwarf Pine Plains, yet it is also one of the best examples of an endemic Pine Barrens species well-adapted for life under the harsh conditions here. The Buck Moth is so successful at overcoming these conditions that its population in the Dwarf Pine Plains is the densest one known for this rare and localized insect. Each year, over 1000 moths emerge from each Dwarf Pine Plains acre, ten to

100 times the average of Buck Moth populations in other Pine Barrens areas.

Restricted to Pine Barrens and related ecosystems, the Buck Moth is distributed from east Texas to Cape Cod along the Atlantic Coastal Plain, and inland in scattered dry locations in the Mississippi Valley and the Appalachian Mountains. Its caterpillars feed on different species of xeric oaks, mostly small trees and shrubs. In the Northeast, the caterpillars feed mostly on Scrub Oak and sometimes on Dwarf Chestnut Oak (*Quercus prinoides*), two shrubby oaks common in Pine Barrens areas and rare or absent elsewhere.

The life history of the Buck Moth is very unusual for an insect, reflecting its many adaptations for Pine Barrens life. The adult moths emerge from their underground resting stages, or pupae, during the fall, mostly in October. They fly during the day from mid-morning to midafternoon, and their bold markings of white bands on dark black wings with scarlet on the legs and tip of the abdomen render them highly visible; to many people they more resemble butterflies than moths. The fall flight period is one of the last of any insect before winter sets in, and it is an adaptation to avoid droughty and fire-prone conditions during the warm season. Diurnal flight is necessary because the normal nocturnal flight time of most moths is too cold in the middle to late fall. Buck Moths are mostly black to absorb the sun's warming rays to maintain their ability to fly in the cool autumn air, and their bright white and red markings are warnings to the many bird species migrating south at that time of year that Buck Moths are protected by noxious substances.

Each adult moth lives for only a few days, surviving on fat stored up when it was a caterpillar. In this short time, the males must find the females and mate, and the females must locate the host plant (only Scrub Oak is used in the Dwarf Pine Plains) and lay their eggs. The flight of males in search of females begins at about 10:00 AM and ends about 3:00 PM and is spectacular in the Dwarf Pine Plains, where thousands of the brightly-colored moths can be seen in a single day. It is hard to believe that the Buck Moth is so rare and endangered a species while viewing such an assemblage in a small area like the Dwarf Pine Plains, but just a few miles away, in the nearby oak forests and other types of

habitats, there are no Buck Moths at all, and even in the Pine Barrens regions surrounding the Dwarf Pine Plains there are few.

The female lays her eggs in a golden ring around Scrub Oak twigs, then dies. Thus the species spends the winter as egg rings glued to the host plant. The eggs are coated by a waxy secretion which protects them from the rigors of winter, and it also makes the eggs somewhat drought and heat resistant. The eggs hatch in late May, giving forth spiny black caterpillars which are poisonous, stinging any attacking creature with their sharp spines and injecting an irritating substance which causes painful swelling. The caterpillars stay together on the Scrub Oak and feed, maximizing their deterrent effect by grouping. They go through six stages, or instars, shedding their skins between each to accommodate their explosive growth. By the fourth instar they are about 1½ inches long and have changed color, gaining yellow stripes and orange spines. Each caterpillar cluster splits up at this stage to avoid parasitism by the many tiny wasp and fly species which lay their eggs in caterpillars and which are the primary natural control of Buck Moth numbers. The caterpillars wander freely until they each find new Scrub Oaks to ascend and feed on (this is one characteristic which explains why Buck Moths need large undeveloped Pine Barrens areas for survival). By the end of July the caterpillars are over two inches long and at the end of their six or last stage. They descend once again and search for suitable resting sites, then burrow into the sandy soil and hollow out small caverns about two inches below the surface -- just deep enough to avoid the killing effects of late summer and early fall blazes which often burn the Dwarf Pine Plains and the rest of the Pine Barrens.

A new generation of adult Buck Moths emerges from the thousands of pupae which spend the hottest months underground. But sometimes a droughty period will occur in the Pine Barrens. Its effects may be especially severe in the Dwarf Pine Plains. During these dry spells the Buck Moth pupae will not give forth new moths, but will wait until the following year to insure enough soil moisture for survival. The pupae can wait for four or more years before producing adult moths if a prolonged drought, such as the one of the mid-1960's on Long Island, occurs. This is a desert adaptation, similar to that of desert wildflowers which are

not seen for many years yet suddenly appear in profusion, bloom, set seed, die, and wither away after the infrequent desert rains come. It belies the desert origins of the Buck Moth and its relatives; many of the other Dwarf Pine Plains species are also related to desert plants and animals of have retained desert adaptations that work well in the Pine Barrens.

No one is sure of why the Buck Moth reaches such great abundances in the Dwarf Pine Plains, far in excess of its next most abundant populations. It is no more abundant in the New Jersey Dwarf Pine Plains, for instance, than it is in surrounding regions of the New Jersey Pine Barrens -- about 5 or 10 adult moths per acre. It is not found in the Shawangunk Mountains Dwarf Pine Plains. Perhaps the Long Island Dwarf Pine Plains presents just the right combination of habitat characteristics to favor the Buck Moth over its natural enemies far more than in surrounding parts of the Long Island Pine Barrens. Certainly the extremely hot and dry microclimate, poor, sandy soils, and great Scrub Oak abundance (it comprises about half of the upper shrub layer; Dwarf Pine the other half) explain some of the success of the Buck Moth there, but many questions remain. For instance, the Oak Brush Plains has greater Scrub Oak abundance than the Dwarf Pine Plains, yet the Buck Moth has only one-tenth or one-twentieth the numbers there as in the Dwarf Pine Plains. Also, up to one-half of the Buck Moth caterpillars, or more in some years, are killed annually by parasitic fly and wasp species, yet the adult moths are still seen each fall in the greatest density of any Buck Moth population. These apparent contradictions and others await explanation as the search for the causes of the Buck Moth's remarkable abundance at the Dwarf Pine Plains continues.

Like most Pine Barrens endemic species, the Buck Moth is threatened by habitat destruction primarily. If the Dwarf Pine Plains is destroyed, the largest and densest known Buck Moth population will be lost; if it is preserved, this population can be expected to last indefinitely. If the Dwarf Pine Plains is partially preserved, or the areas around it become developed, and fires cannot be restored or allowed to burn at their natural frequency of once every six years, the Buck Moth population will decline to the low density of the species in surrounding Pine Barrens regions. This is true for many of the other native Dwarf

Pine Plains species -- their high densities or abundances are direct effects of the existence of the low vegetation structure of the pygmy forest. If the Dwarf Pine Plains becomes overrun by tree-sized Pine Barrens vegetation because of disturbance and fire suppression, both of which are serious threats to the region now, it will lose its distinctive species composition as some species, like the Buck Moth, decline in numbers while others disappear entirely from the region, and in some cases, from the Pine Barrens.

Short-term and Long-term Threats to the Dwarf Pine Plains

Although it is located in the heart of the Long Island Pine Barrens, far away from the "battle front" of development pressure in central Suffolk County (which has been stalled since the 1973-74 oil crisis and recession, waiting for better economic times), the Dwarf Pine Plains has been, and still is, the target of many massive real estate development schemes. It is a sad commentary on the condition and priorities of our society and government that such proposals are still being made and seriously entertained despite the great increase in public awareness of the uniqueness and values of the Dwarf Pine Plains, and the Pine Barrens in general.

In 1977, a group of private developers, with the approval and assistance of Suffolk County, proposed the establishment of a federally-designated free trade zone and industrial park on 300 acres in the Dwarf Pine Plains, north of Suffolk County Airport and east of the Riverhead-Westhampton Road (see map 3). The proposal would have directly destroyed the 300 acres and would have probably led to the complete loss of the entire Dwarf Pine Plains had it not been vigorously opposed by many organizations and public officials. At federal hearings in June 1978, a great amount of information about the existence, location, rare and local pine barrens species there, and uniqueness and significance of the Dwarf Pine Plains was presented in an open public forum for the first time. Many private citizens and public officials learned for the first time about this fascinating area, and joined the battle against the free trade zone and industrial park. The final blow was self-inflicted, when the developers, after promising the officials of Suffolk County and Southampton Town that no work would be done until all environmental reviews were completed, turned around and bulldozed about 20 acres of pristine Dwarf



The Buck Moth reaches its maximum abundance and density, about 1,000 individuals per acre, in its range in the Long Island Dwarf Pine Plains. It is endemic to Pine Barrens and related arid regions and has been nominated for placement on the New York State Endangered Species List.

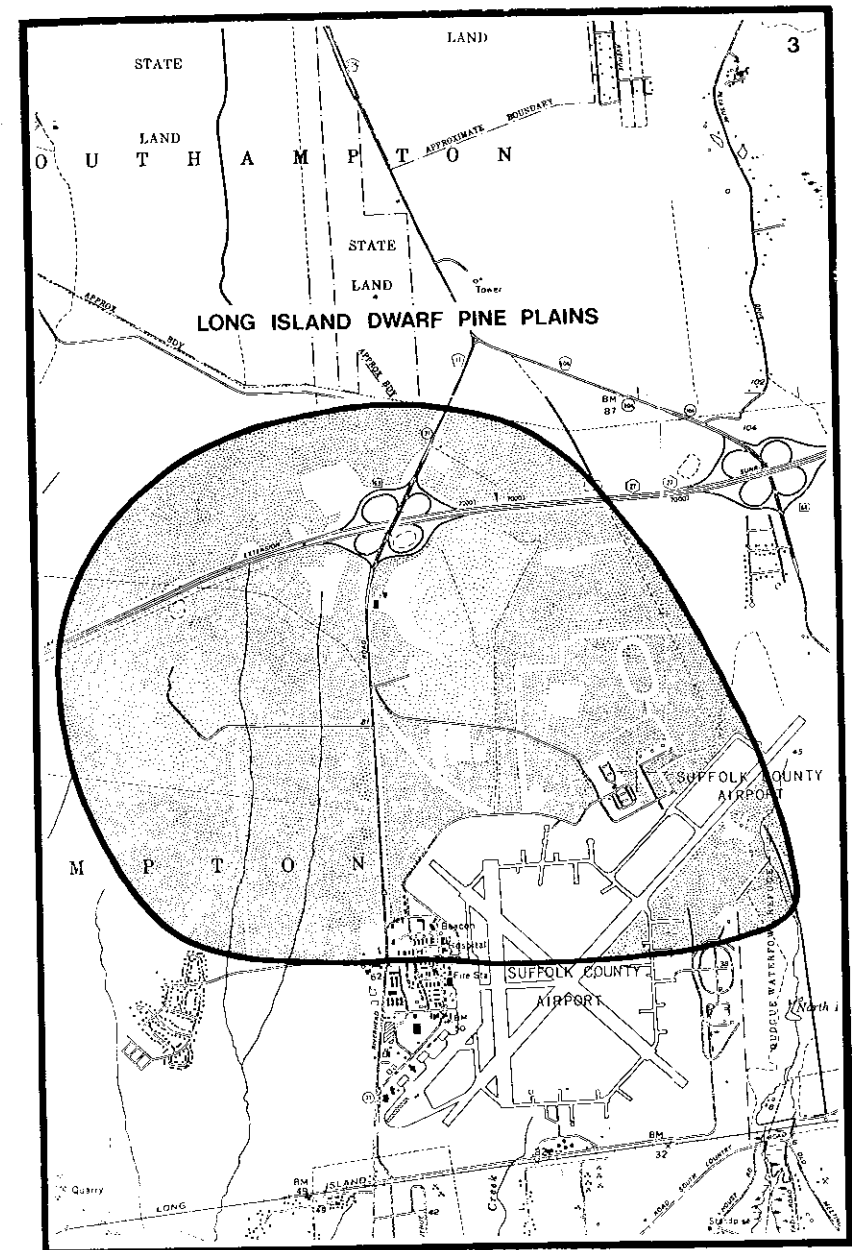
Pine Plains on their property before being halted by the town and the New York State Department of Environmental Conservation. Their credibility lost, the county withdrew its application to the federal government for free trade zone status for this property, and the development scheme was abandoned -- for now.

The most recent large-scale threat to the Dwarf Pine Plains

communities, collectively known as the Long Island Pine Barrens Barrens, from which the endpoint one developed, and upon which it is totally dependent for its survival.

One of the chief ways that the "core" Dwarf Pine Plains area is dependent on the surrounding communities is in its fire frequencies. All of the Dwarf Pine Plains regions known, in New Jersey, the Shawangunk Mountains, and on Long Island, have very high fire frequencies (about one fire every six years) and are surrounded by large areas covered by other types of pine barrens vegetation. The very frequent fires in the pygmy forests are made possible because they are so deeply embedded in other natural areas that burn, although not as often. In the case of the Long Island Dwarf Pine Plains, fires decrease in frequency slowly as one moves from the "core" area through the transition zones, to the other pine barrens vegetation formations; but as soon as one moves past the edges of these surrounding pine barrens areas, fire frequencies drop steeply. And when one moves out of these peripheral pine barrens regions into developed areas, the number of fires drops to near zero. So the pine barrens surrounding the "core" area of the Dwarf Pine Plains provides two fire benefits: it keeps the Dwarf Pine Plains buffered and far removed from the fireless edges of the Long Island Pine Barrens, where fire frequencies are lower because fires start less often and are put out more often; and the surrounding pine barrens areas are the sources of many fires which have high probabilities of reaching the Dwarf Pine Plains and burning through it. The geography of the Dwarf Pine Plains and its geographical relationships with its surrounding pine barrens regions are essential influences on

FACING PAGE -- The map shows the boundaries of the "core" low area of the Dwarf Pine Plains and all features of interest, including trails, natural and disturbed vegetation, and buildings. Disturbed areas vegetate very slowly, beginning as low tundra-like expanses and progressing to "heaths", areas dominated by heath plants like Black Huckleberry, Bearberry, Wintergreen, and Blueberries. The "core" area originally covered about 2,500 acres, making it the smallest Dwarf Pine Plains region; because of various developments and disturbances, less than 2,000 acres remain. It is vital to the long-term health of the Dwarf Pine Plains that the entire "core" area and the surrounding transition zones be preserved to insure the frequent wildfires necessary for Dwarf Pine Plains perpetuation.



the maintenance of the required high fire frequencies which sustain the pygmy forest. Along with very dry, porous soils and low, flammable, and easily dessicated vegetation, centralized location within a much larger pine barrens region is required to develop and perpetuate a Dwarf Pine Plains region.

In the case of the Long Island Dwarf Pine Plains, then, there are two levels of preservation problems which have to be solved. The first is the threat (and actual occurrence, in some instances) of direct destruction of the Dwarf Pine Plains through real estate development. This can be solved by the acquisition of the area. Any acquisition of part or even all of the approximately 2,000 acres left in the "core" pygmy forest area will not solve the second, longer-term problem -- the decrease in fire frequencies and interaction among the species and individuals of surrounding regions that will affect the "core" area if only it is preserved and the surrounding transition zones and other pine barrens areas are developed. If the fire frequencies of the Dwarf Pine Plains are decreased by development of the surrounding pine barrens areas and subsequent fire suppression to protect the developed areas, the Dwarf Pine Plains distinctive low pygmy forest will be overwhelmed by tree-sized Pitch Pines and perhaps even by other species not now found in the "core" area. Fire suppression over the past forty years throughout the entire eastern Long Island Pine Barrens region has already seriously decreased fire frequencies in the Dwarf Pine Plains (and elsewhere in the pine barrens). If fires are further decreased in frequency and intensity, the process of invasion by tree-sized Pitch Pines will be exacerbated, and the trees will eventually move out of their footholds in the disturbed parts of the "core" area (where they now persist because of the lessening of fires) and swallow up the pygmy forest.

The only lasting solution to both the short-term threat of direct habitat destruction by development and the long-term threat of fire suppression and the consequent overrunning of the Dwarf Pine Plains by tree-height vegetation is the acquisition and preservation of not only all of the "core" area, but also of the over 10,000 acres of transitional vegetation around it and the approximately 20,000 to 30,000 acres of natural pine barrens vegetation around that. Although this sounds extreme, it is in fact the only lasting solution to the many habitat destruction and alteration threats now facing the Dwarf Pine Plains. Acquisition of Pine Barrens

land on such a grand scale will, of course, not only insure the future of the Dwarf Pine Plains, but also the existence of the transition zones and many other Pine Barrens communities surrounding the Dwarf Pine Plains, including pine-oak and oak-pine woodlands, and many types of wetlands.

But how is such a massive land acquisition program to be undertaken and financed? The limited resources of local governments will not be enough; it will require the assistance and funding of federal and state agencies. A successful model for acquiring and preserving a large, sensitive Pine Barrens region already, fortunately, exists, in New Jersey. A New Jersey Pine Barrens National Reserve has been established covering about 740,000 acres of the formerly 1.1 million-acre New Jersey Pine Barrens. The Reserve boundaries contain an outer Conservation Zone and an inner Preservation Zone; in the latter, almost all of the land is to be acquired for preservation using a combination of federal and state funds. In the Long Island Pine Barrens, a similar Reserve could be set up, covering the almost 100,000 contiguous acres of the central Suffolk County area of the Pine Barrens, along with important isolated tracts such as the Oak Brush Plains at Edgewood and Pinelawn, the South Fork Pine Barrens, and the South Setauket Pine Barrens. The Dwarf Pine Plains would be in the heart of any reserve established, thereby insuring its long-term survival.

The federal and state legislative actions to set up and manage a Pine Barrens Reserve on Long Island must be preceded by public interest and understanding of the importance and value of the Pine Barrens and its many communities like the Dwarf Pine Plains. Only through public pressure on elected officials, inspired by appreciation of the sensitive and threatened nature of such fascinating regions as the Dwarf Pine Plains, will the concept of a much-needed large central preserve on Long Island, a Long Island Pine Barrens Reserve, become reality. The future of the Dwarf Pine Plains and other Pine Barrens natural communities depends on its establishment in the next decade. Time is short, and much remains to be done to convince the people and their elected officials of the importance of the Long Island Pine Barrens and the need to act quickly. Otherwise the Dwarf Pine Plains, a unique assemblage of plants and animals adapted to some of the harshest conditions on earth, will succumb in a few short years to the short-sightedness of modern civilization.

The Long Island Pine Barrens Task Force

by Robert T. McGrath

The Long Island Pine Barrens Task Force was created in 1978 to address many of the critical land use issues that will affect the future of the Long Island Pine Barrens. The task force members were appointed by the Commissioner of the New York State Department of Environmental Conservation, and they include state, Suffolk County, and local officials, as well as planners, environmentalists, and conservationists who represent many diverse public and private organizations. Meetings of the Pine Barrens Task Force are chaired by Don Middleton, DEC Region 1 Director, and are held once a month at the DEC Regional Office at the State University of Stony Brook. Over its life, the Task Force has evolved into an advisory body to the DEC Commissioner and Region 1 Director on Pine Barrens issues.

As a group or through subcommittees, the Task Force has made recommendations covering such issues as the impacts of proposed developments within the Pine Barrens; protection of Pine Barrens groundwater; land acquisition priorities; and management of Pine Barrens lands. The Task Force was instrumental on drafting and reviewing proposed legislation for federal assistance to acquire lands within the Pine Barrens.

The generous gift by the RCA Corporation of 7,200 acres of Pine Barrens lands in two parcels (Rocky Point, 5,200 acres; and Riverhead, 2,000 acres) to DEC provided the initial impetus to start the Task Force. Two major development proposals dominated Task Force discussions in 1978 -- the construction of two golf courses in wetlands surrounding Swan Pond, near Manorville, in the headwaters of the Peconic River; and the threatened loss of 300 acres of the Dwarf Pine Plains near Westhampton for a proposed trade zone and industrial park. Intense public support for the preservation of these two areas was also a factor that prompted the formation of a state-level Task Force to solicit recommendations.

Through its meetings, the Task Force has considered a number of land use and management philosophies in the Pine Barrens, including preservation, conservation, partial

development, and full development. These scenarios and their implications have been considered in various combinations for particular Pine Barrens tracts, and the Task Force generally considers the environmental, economic, and social characteristics of a parcel or proposed change in its status before giving its opinion. Recently, the Task Force went on record in opposition to the proposed "Hampton Hills" development on 1,600 acres in Southampton Town (see article on the Dwarf Pine Plains in this issue).

The Task Force has also delineated boundaries for a proposed central Pine Barrens Preserve covering about 93,000 acres and running from Rocky Point RCA to the Shinnecock canal. These boundaries (nicknamed the "Pine Line") do not enclose the entire Pine Barrens, only the largest contiguous, mostly natural area left in its heart. They closely coincide with the boundaries of "Zone III" of the Nassau-Suffolk "208" Comprehensive Wastewater Management Plan, and this coincidence has led many to link the largest open space left on Long Island, the central part of the Pine Barrens, with the largest area of clean groundwater left. The relationships between water extraction and water table levels in Pine Barrens wetlands, the possible transport of water long-distance in Nassau and Suffolk, and such issues as existing water quality in and under the Pine Barrens, locating prime recharge and outflow areas, and point pollution sources in the area have been addressed by the Task Force.

Areas outside the original "Pine Line" area have also been considered. The Task Force has spent significant time making recommendations on the preservation of key tracts such as the Oak Brush Plains at Edgewood, the South Setauket Pine Barrens, and the South Fork Pine Barrens. Another, smaller study area has been outlined for the South Fork. While the preservation of large, contiguous undisturbed tracts is a primary goal of the Task Force, it is recognized that there are many smaller remnant parcels worthy of preservation because of their unique ecological characteristics. In many cases, there are only a handful of areas left undisturbed in certain Pine Barrens regions, like the Oak Brush Plains.

Pine Barrens management options and practices have also been examined by the Task Force. On this subject, there have been considerable disagreements, but the Task Force has agreed that information on the following topics should be incorporated

into any Pine Barrens management plan: a comprehensive study of the biota and ecosystems of the Pine Barrens; rare, endangered, and threatened species and their habitats; the importance and natural frequencies and intensities of Pine Barrens wildfires; the designation of each Pine Barrens area in terms of its ability to survive various forms of development; and a list of priority areas for acquisition.

The Task Force has issued a report of its findings, activities, and recommendations to the DEC Commissioner. In this report, ten priority areas are recommended for public acquisition, including the Dwarf Pine Plains, Maple Swamp, Peconic Headwaters, Manorville and Riverhead Hills, Grace's Woods, and the Oak Brush Plains. The report addresses what options are available for the management of the remaining Pine Barrens lands inside the 93,000-acre "Pine Line" area, and recommends that the federal and state governments provide funds for planning, acquisition, and management of Pine Barrens lands.

Task Force meetings are open to the public and are generally held on the third Thursday of each month. To receive information on meeting dates and agendas, write to the New York State Department of Environmental Conservation, Building 40, SUNY at Stony Brook, Stony Brook, Long Island, New York 11794, or phone (516) 751-7900.

The Long Island Pine Barrens Society is represented on the Task Force by two officers and several members. While the Pine Barrens Task Force up to now has been only an advisory body to the DEC, it has the potential to accomplish much more for the Pine Barrens if funding can be found for planning, acquisition, management, and education activities in the Pine Barrens. It is hoped that the Pine Barrens Task Force can evolve into an official government body which can, together with the Long Island Regional Planning Board and local government agencies, attract funds to conserve and manage the Pine Barrens.

The Eastern Spadefoot Toad in the Long Island Pine Barrens

by John L. Turner

One of the most interesting, yet least familiar, animals indigenous to the Long Island Pine Barrens is the gnomish-looking Eastern Spadefoot Toad (*Scaphiopus holbrooki*). Primarily a nocturnal creature, the Eastern Spadefoot is not well known because of its retiring nature and increasing scarcity as a result of habitat destruction.

The Eastern Spadefoot Toad is not a true toad like the Fowlers and American Toads (family Bufonidae), but belongs to a closely related family, the Pelobatidae. In North America, this family is represented solely by the genus *Scaphiopus* which contains five species. This group, somewhat surprisingly, appears to have arisen and evolved in the harsh, arid regions of the southwestern United States. Being adapted to living in hot, arid environs has served the Eastern Spadefoot Toad well in surviving within the xeric soils characteristic of the Long Island Pine Barrens. While the other four Spadefoot Toad species are restricted to the western United States, the Eastern Spadefoot ranges east of the Mississippi River, favoring sandy lowland areas, from southern New England to Florida, westward to Missouri and Arkansas.

Reaching three inches in length, the Eastern Spadefoot Toad is an attractive amphibian, being dark brown in color on the back (see photograph). Running down each side of the back is a sepia-colored line that together forms an interesting lyre- or hourglass-shaped figure. The sides of the toad are warm brown in color also, and the ventral side is creamy white. Distributed on the sides and back are many small, salmon-colored warts. The Eastern Spadefoot possesses a number of other distinctive features that set it apart from other frog and toad species. For a toad, it has rather smooth skin, and partially or entirely lacks the large pair of paratoid glands that many toad species have behind their eyes. Also, the Eastern Spadefoot has vertically oriented pupils in its eyes, unlike most other frogs and toads whose pupils are horizontally oriented. This lends an interesting catlike

appearance to its face. Finally, the Eastern Spadefoot possesses, as its name suggests, a single, sharply edged "spade" on the margin of each hind foot which enables it to dig into the soil very quickly when necessary. Sitting on its haunches, the Spadefoot Toad rocks from side to side while digging, scooping soil upward as it slowly descends from sight.

The Eastern Spadefoot Toad spends much of the year burrowed in the earth, emerging usually in the months of June and July to the first heavy, prolonged rains at that time (an inch or more in a 24-hour period). The males often emerge first, migrating to local breeding sites too, by following the direction from which the calls are coming. The loud chorus of males stimulates and assists females in locating these essential breeding spots. Hence, a local population is very often successful in reproducing, once a few individuals "advertise" to others that an appropriate breeding locale has been discovered.

The call of the Eastern Spadefoot Toad is unique and unlike that of any other native Long Island amphibian species. Described as a loud "wank", the call carries well and can be heard from a distance of one mile. Watching male toads call is amusing, for they inflate their vocal sacs fully and then throw their bodies forward as they begin emitting sounds. They call while clinging to vegetation, floating in the water, and as they sit on the shore.

Upon hatching, the larvae develop rather quickly, since Eastern Spadefoots often breed in temporary pools that evaporate rapidly under the intense summer sun. This rapid larval development is another adaptation which belies the Spadefoot's desert origins.

With the onset of autumn, the Eastern Spadefoot again

FACING PAGE -- An adult Eastern Spadefoot Toad, after emerging from the ground following a heavy rain. Spadefoots remain underground most of their lives, coming to the surface to breed and forage. Two identifying marks visible in this photo are the lyre-shaped dark mark on the back and the dark cross in the eye which breaks the gold iris into four sections when the pupil is dilated. Spadefoots are desert creatures, and their adaptations to arid regions serve them well in the Pine Barrens.



burrows down into the protective earth where it overwinters, awaiting the warm rains of next year. Many individuals develop an insulative cocoon of dead skin which prevents desiccation during this period. In addition to the protection afforded by dead skin, Spadefoot Toads can burrow very deep, well below the frost line; toads have been dug up from depths of six feet! There have been recorded occasions, involving the Hurter's Spadefoot, a western species, where housing developments built in dry weather have been overwhelmed by hordes of Spadefoot Toads emerging from lawns after torrential downpours.

On Long Island, the Eastern Spadefoot Toad is most common in the less-developed areas of the eastern end. The largest population seems to be concentrated in the headwaters of Long Island's largest stream and the largest Pine Barrens river in New York State -- the Peconic. At least one significant population is known from the South Fork. Some smaller populations may still persist in the central and western portions of Long Island, although field work suggests that it has been largely exterminated there.

Like so many other plant and animal species indigenous to Long Island, the Eastern Spadefoot Toad has declined for a number of reasons. Habitat destruction, caused by suburban sprawl, apparently is the principal factor. In addition, poisoning due to the use of pesticides, and the stocking of breeding sites with fish are important causes of the toad's demise.

If we are to insure the continued survival of the Eastern Spadefoot Toad, and indeed most of the amphibians native to Long Island, it is essential that, in addition to preserving known breeding locations of these interesting animals, we save large tracts of adjacent uplands which are undeveloped. This is critical, for many amphibian species spend a great deal of the year away from wetland areas, only using them for reproductive purposes. To preserve just the breeding locales will not be enough.

If large tracts of surrounding woodland are left undeveloped, we can hope that, for years to come, on warm rainy nights in late spring, the Eastern Spadefoot Toads will continue to emerge and fill the night air with their hauntingly beautiful mating chorus.

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The Long Island Pine Barrens Society is a nonprofit environmental organization dedicated to the preservation and understanding of Long Island's Pitch Pine/Scrub Oak woodlands. Estimated to originally encompass over 250,000 acres, across two counties and nine townships, the Pine Barrens have, over the last half century, been severely decimated by residential, commercial, and industrial development. At present, about 80,000 to 100,000 acres persist in fairly natural condition, constituting the largest wild region left on Long Island, but they are threatened with the same fate which has befallen many of the rich and diverse natural landscapes that once characterized the island. It is primarily because of this threat to a region containing many of the rarest, most interesting, and rapidly disappearing native species and natural communities in the East that the Society was formed.

The Society has two major objectives: First, we work with and try to influence private citizens and public officials at all levels of government who make decisions or policies affecting Long Island's Pine Barrens. Second, through slide presentations, lectures, displays, field trips, our newsletter, and other publications, we promote interest in, and understanding of, the distinctive creatures and natural processes of this fascinating area. All Society activities are undertaken with the ultimate goal of preservation of the Pine Barrens.

There are two membership categories: Regular (\$5.00 per year) and Supporting (\$10.00 annually). Members receive *The Heath Hen*, our quarterly newsletter, other Society publications at reduced rates, and participate in Society field trips and meetings. Send dues and inquiries to the address above.