An Introduction to the Long Island Pine Barrens

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The Long Island Pine Barrens is a natural region characterized by open, sunlit woodlands dominated by Pitch Pine, Long Island's only native hard pine (other hard pines are native south along the Atlantic Coastal Plain) and the most fire-resistant tree species in eastern North America. In some sections of the Pine Barrens, Pitch Pine is the only tree species present; in others, it co-dominates the woodlands with Scarlet, White, Black, Red, or Post Oaks in the uplands, and Red Maple, Tupelo, and Atlantic or Coast White Cedar in the lowland streams, bogs, and swamps.

Originally, the Pine Barrens extended over one quarter of the land surface of Long Island (250,000 acres), from the eastern edges of the famous Hempstead Plains grassland in southern Nassau County, through the towns of Huntington, Babylon, Smithtown, Islip, and Brookhaven in western Suffolk County, to the towns of Riverhead, Southampton, and Easthampton in eastern Suffolk (see map), a distance of nearly eighty miles. Most of the central and southern parts of Suffolk County, as well as an isolated area on the South Fork, fall within the limits of the Pine Barrens.

The Pine Barrens is distinguished by an unusual biota consisting of many plant and animal species which do not occur in the various deciduous forest communities (such as the Oak-Hickory forests of northwestern Long Island or the Beech-Maple-Hemlock forests which cover the Appalachian Mountains at this latitude) in the Northeast, or which are very rare outside Pine Barrens regions. Pitch Pine, for instance, occurs more abundantly in only one other area: the New Jersey Pine Barrens to the south of Long Island. It is otherwise very rare or absent from most deciduous forests in the east. Scrub Oak, a low thicket-forming shrub abundant in the upland Pine Barrens, likewise is almost never found outside Pine Barrens regions.

The structure of Pine Barrens vegetation, as well as its species constituents, is very distinctive. Most upland Pine Barrens areas are known as "shrub savannas" by vegetation scientists because they consist of dense knee- to head-high thickets of two shrubby oak species, Scrub Oak and Dwarf Chestnut Oak, and smaller shrub species like Black Huckleberry, Lowbush Blueberries, Sweet Fern, Winterberry, Pine Barrens Heather, Sheep Laurel, Prairie Willow, and Bearberry, overtopped by a broken canopy of slender, scraggly Pitch Pine and small tree-sized oaks. The shrub layer is usually dominant, whereas in a typical eastern deciduous forest, the tree layer predominates, allowing little light to penetrate to the shrub layer, which consequentially is sparse and irregular. The herbaceous or non-woody plant layer of Pine Barrens areas, incorporated within or beneath the dense shrub layer, contains many unusual and rare species (such as Bracken Fern, Wild Indigo, Blue Lupine, American Goat's-Rue, Narrow-leaved Aster, and Birdsfoot Violet) which can only grow in the open sun-drenched Pine Barrens vegetation, and which die if shaded by other plants.

Why and how does such a relatively small area as the Long Island Pine Barrens (which contains less than one percent of the land surface of New York State) support this assemblage of unusual plants and animals and maintain its characteristic vegetative structure while surrounded by deciduous forests? Why doesn't the deciduous forest invade the Pine Barrens or why doesn't the Pine Barrens become deciduous forest? How did the Pine Barrens become a repository of rare creatures not found elsewhere? To answer these and many other questions about the origins and present existence of this anomalous natural region one must examine the natural forces at work in the Pine Barrens and find how they differ from natural forces elsewhere and why they produced a result so strikingly different from the more "normal" or typical eastern deciduous forest.

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Two major natural forces or causative agents created the Pine Barrens and now maintain this region. The first is the soils of the Pine Barrens, which, in comparison with most deciduous forest soils, are very low or lacking in most necessary plant nutrients, very course or porous and therefore well-drained or poor at holding rain water, and very harsh or acid. These soils developed on loose sandy and

gravelly layers of sediment which were deposited by two advances of glacial ice approximately 60,000 and 23,000 years ago, respectively. The first glacial advance formed the middle range of hills on Long Island, the Ronkonkoma Moraine, which runs from northwestern Nassau County to Montauk Point. The second, more recent, advance stopped near the present-day north shore of Long Island and deposited the Harbor Hill Moraine, which runs from Greenpoint in Brooklyn to Orient Point at the east end of the North Fork. South of these two rows of hills great fans or deltas of sand and gravel were spread from debris washed from the glaciers and their moraines by the rushing meltwaters of the wasting glacial ice. The two outwash plains (the Terryville Outwash Plain to the north and the Hempstead to the south) formed by these coalescing sandy deltas today support most of the Long Island Pine Barrens. However, the central portion of the Ronkonkoma Moraine, as well as other scattered segments of it, is sandy and gravelly like the outwash deposits, and is covered by the Manorville and Riverhead Hills region of the Pine Barrens. Most of the two moraines contain enough silt and clay (absent or rare in outwash sediments) to enrich the soil, and increase its water-holding capacity, so no Pine Barrens vegetation exists there today.

Pine Barrens plants and animals moved onto Long Island from the south (many had taken refuge in the New Jersey Pine Barrens, which the glaciers never reached) and west, most coming up the Coastal Plain (which was then very wide because the glaciers had locked up so much water that sea level was lowered approximately 300 feet at maximum glaciation; Long Island and New Jersey were connected by this enlarged coastal plain for a while); some coming down the Mohawk - Hudson River lowlands. This northward plant and animal movement was very slow and took about 20,000 years. There is evidence that it is still occurring today. Pine Barrens vegetation was preceded by low tundra plants immediately after the glaciers receded. Spruce and fir forests and their associated boreal plants and animals became established about 15,000 years ago and mostly followed the tundra species north to Canada and the northern United States as the climate ameliorated. For a time (12,000 - 9,000 years ago) the dominant pine of the Pine Barrens was probably not Pitch Pine, but Jack Pine, a slender northern tree which is well-suited to sandy soils but thrives in climates much cooler than those of present day Long Island. The

climate continued to grow warmer and became drier as well, reaching its maximum warmth and aridity during a period known as the Xerothermic Interval (8,000 - 5,000 years ago). During this time most of the present Pine Barrens species arrived and gained dominance. Pitch Pine became the pre-eminent tree of the region during the Xerothermic Interval, and along with the other unusual plants and animals, persisted to the present because of the second major natural force shaping the Pine Barrens -- Fire.

Periodic natural wildfires are the "lifeblood" of the Long Island Pine Barrens. These fires, which are usually very hot and burn very rapidly, occur every five to twenty-five years in the region, depending on location, condition of the vegetation, and time since the last major fire (by comparison, eastern dediduous forests burn every 100 to 4,000 years, often with light ground fires that do not kill mature trees). They start because the soil of the Pine Barrens is so dry that the ground layer of fallen leaves and twigs is like tinder throughout much of the year. The extremely acid nature of the soils also contributes to the flammability of the area by killing or suppressing most common groups of decomposing organisms (such as earthworms and bacteria) thus allowing the organic litter layer to build up very rapidly after each fire, creating optimal conditions for the next fire. Most woody Pine Barrens plants also help create fire-prone conditions by manufacturing waxes, oils, resins, and turpenes in their leaves and stems (this is one reason why many Pine Barrens shrubs have shiny, waxy leaves - another reason is to protect the leaves from water loss during the hot, dry summers). The open sunlit vegetation structure, combined with light sandy soil, traps and holds heat, contributing to the droughtiness and ignition potential of the leaf litter and the spread and intensity of wildfires.

All native Pine Barrens plants and animals are adapted to the frequent fires in one or more ways. Most herbaceous and woody plants have large, deep-reaching root systems that store great quantities of starch below ground. Many of these plants, like icebergs, have far more of themselves below the surface than above. They are killed to ground level by the fires but not below because the soil insulates their roots well from the lethal heat. By using their stored food reserves they are able to resprout and regenerate their

above-ground stem and leaf structures almost immediately after a fire. It is not uncommon to return to a charred, fire-blackened section of the Pine Barrens two months after a fire and see the area completely covered by new growth from a multitude of extensive underground root systems. Scrub Oak, especially, has enormous swellings called root crowns below the soil surface from which new stems can grow over three feet tall in a few months after a fire.

Pitch Pine is capable of surviving fires from above or below ground. Small seedling or sapling trees resprout from protected underground buds if their original stems are killed. Larger trees (generally over 3" diameter breast height, depending on fire intensity) have very thick insulating bark which chars, but does not burn, and protects the living cambium layer beneath it. After severe crown fires, which blacken the Pitch Pines and kill their crowns or branches, the still-living trunks send out new branches from epicormic buds located beneath the bark where they are protected from fires. Pitch Pines take on their characteristic gnarled appearance after losing and resprouting their crowns, branches, or upper trunks several times after fires.

Pine Barrens animals survive wildfires in three major ways: they either burrow (small mammals, reptiles) underground, leave the area and return later (many birds and larger mammals), or part of their populations are killed and depend on quick recolonization from adjacent unburned tracts (most insects, some small vertebrates). Most animals restricted to Pine Barrens or similar habitats have many interesting adaptations to requent natural fires. A rare Pine Barrens insect, the Buck Moth, for instance, always has a portion of its populations resting underground as pupae, so that if the above-ground eggs, caterpillars, or adult moths are killed by fire, some adults will be able to emerge and reproduce the same year.

While the frequent natural wildfires pose severe life-threatening challenges to each species, in response to which these organisms have evolved specialized survival strategies over the millenia, fires also confer a vital benefit to the Pine Barrens: they eliminate invading plants and animals which, in the absence of fires, would out-compete and displace the native Pine Barrens biota. A general characteristic of the native Pine Barrens plants is their inability to withstand com-

petition from species with strongholds in deciduous forest regions. Most animals of the Pine Barrens are dependent on the plants for one or more aspects of their lives (such as food, nesting sites, cover, shelter, support of animals preyed upon) and therefore share this vulnerability to competition from non-Pine Barrens species. By adapting to the extremely harsh conditions of this region (frequent wildfires, hot microclimates, droughty, acidic, nutrient-poor soils) Pine Barrens exist by default because these conditions, especially wildfires, keep competing species out or eliminate them if they become established. In a sense, a sort of natural tension zone exists at the margins of the Pine Barrens, where many deciduous forest and introduced weedy species are constantly invading and constantly being destroyed by fire. As long as this tension is in balance, the Pine Barrens thrives.

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Because of regional differences in soils, fire frequencies, topography, micro-climate, and vegetation history, the Long Island Pine Barrens can be broken down into several loosely bounded biogeographic sections or local areas based on broadly-defined characteristics of the biota, especially the vegetation of each local subregion (see map). Several of these sections are so distinct that they were recognized by early colonial writers with no biological or natural history backgrounds. It seems natural to continue to use these local sub-regional designations because they reflect the underlying biological diversity in species numbers and distribution as well as vegetation composition and structure, of the Pine Barrens. It is important to remember, however, when using such typological human inventions to classify landscapes as complex as the Pine Barrens, that plant and animal species vary continuously in distribution and abundance across the land surface, forming gradients of species and species groups (or biological communities, as they are are called by ecologists) that cannot be expected to conform completely to a simple classification into sub-regional categories such as the one given here.

A major gradient of change in the Pine Barrens runs parallel to the long axis of Long Island, or roughly west to east. The westernmost distinct section of the Pine Barrens, the Long Island Oak Brush Plains, is characterized in dry uplands by very low thickets (usually knee to waist

high) of Scrub Oak and Dwarf Chestnut Oak, with widely-scattered, slender Pitch Pines. In some areas of the Oak Brush Plains, there are no pines for many acres, and the relationship of this area to the now almost-vanished Hempstead Plains grassland, (the easternmost true prairie in the U.S.) to the west is clearly seen. Many of the prairie plants of the Hempstead Plains (such as Bluestem Grasses, Prairie Switchgrass, Wild Indigo, and Birdsfoot Violet) now have strongholds in the Oak Brush Plains. Some Pine Barrens plants, like Dwarf Chestnut Oak, reach peak abundance in this part of the Pine Barrens. Blackjack Oak, an endangered plant on Long Island, has remnant populations in the Oak Brush Plains. The area was one of the strongholds for the now extinct Heath Hen.

Eastward, the Oak Brush Plains grades into the drainage of one of the three major Long Island Pine Barrens streams, the Connetquot River (the others are the Carmans and the Peconic Rivers). Beyond this stream the Pitch Pines increase in density, and fewer open, treeless expanses of the shrubby oak thickets are seen. Dwarf Chestnut Oak declines in abundance, and many of the plants of the Hempstead Plains which are also found in the Pine Barrens become rarer. More tree-sized oaks are seen with the Pitch Pines in many upland areas, in some places shading and breaking up the lower shrub layers. This middle portion of the Pine Barrens is an area of more subtle changes, except where stream valleys and their associated Pine Barrens wetlands dissect the region. In the Manorville area, Pine Barrens vegetation begins to cover the Ronkonkoma Moraine as well as the outwash plains to the north and south of it. The Manorville Hills, the largest undeveloped area left on Long Island, and the Riverhead Hills regions encompass this porous part of the moraine, and form a beautiful combination of coastal plain, pine/tree oak woodlands on steeply rolling knob-and-kettle topography unlike any other part of the Pine Barrens.

Along the outwash plain to the south of the hills, a startling change takes place. The Pitch Pines, now in dense gloomy stands over a ragged Scrub Oak layer (Dwarf Chestnut Oak has largely disappeared) begin to slowly decline in average height from about 50 to 60 feet to 20 to 25 feet. For several miles this shortened woodland extends until, south of Riverhead, the pines decline abruptly in height over a few hundred yards until they average only 4 to 6 feet tall.

This small section, (an oval area only 2 miles wide) the Long Island Dwarf Pine Plains, is a pygmy or miniature forest dominated by ancient gnarled Scrub Oaks and a shrubby ecotype (or ecological form) of the Pitch Pine. The soils of the Dwarf Pine Plains and vicinity are the driest, most acidic, and most nutrient-poor of the entire Pine Barrens region. Fires occur here very frequently--about once every six years. The Pitch Pines here respond much like the Scrub Oaks, having developed massive root crowns that survive fires entirely below ground and send up new shoots afterward. Some of these root crowns are over 100 years old and have resprouted dozens of times.

Pitch Pine produces two kinds of cones: "open" cones, which open every fall naturally and drop seed every year, and "closed", or serotinous cones, which usually open only after being heated by a passing wildfire. The majority of tree-sized Pitch Pines produce open cones. But almost all dwarf pines produce closed cones. After a fire, all the cones drop their seed simultaneously onto the ashy sand. Only a small fraction of the seedlings survive the intense competition with older root crowns and other seedlings, but those that do perpetuate the dwarf pine characterstics. In this way, the distinctive dwarfed form of the Pitch Pine overcomes the problems of drought and nutrient poverty, which would tax even tree-sized Pitch Pines, and perpetuates its own line.

Because conditions in the Dwarf Pine Plains are the most adverse for plants and animals in the Pine Barrens, only the most well-adapted species survive here. Most of them have local populations adapted specifically to this region: these adaptations show in reduced growth form (plants) and smaller size (animals) and changes in behavior or life history. Some species, such as Bearberry, Pine Barrens Heather, Orangegrass, and Iceland Moss (a rare boreal lichen), reach peaks in abundance in the Dwarf Pine Plains. The Buck Moth, an endangered black, white, and red day-flying Pine Barrens insect, is more than 100 times more abundant in the Dwarf Pine Plains as in its next densest population. Prairie Warblers and Whip-poor-wills reach their greatest breeding densities on Long Island here. Dwarf Pines exist in only two other small areas, each different from the other and the Long Island Dwarf Pine Plains: the New Jersey Dwarf Pine Plains (called "The Plains" by locals),

and the Shawangunk Mountain Dwarf Pine Plains (recognized only recently).

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Like the uplands, Pine Barrens wetlands are different from those found in deciduous forest regions. The porous sands and gravels underlying the Long Island Pine Barrens contain tremendous volumes of fresh water in aquifers, or water-bearing sedimentary layers. The top of the uppermost aquifer, the Upper Glacial Aquifer, is the water table. This water table intersects the land surface of the Pine Barrens in stream valleys, kettle depressions, and other low spots, forming spring-fed ponds, swamps, and streams.

Pine Barrens water, like the soil, is acidic and very low in nutrients. Only certain groups of wetland plants can grow in these conditions; a large proportion of them are bog species which advanced northward after the glaciers receded and left populations behind in Pine Barrens wetlands. The slow-moving groundwater fed streams which course through the region are deep tea colored by tannic acid from decaying pine needles and oak leaves, and are lined by floating streamside bog mats of Sphagnum or Peat Mosses and heath plants like Leatherleaf, Bog Laurel, Sweet Gale, and Cranberries. Some of the rarer bog wildflowers include many orchid species (such as Calopogon, Rose Pogonia, White Fringed Orchid and Arethusa) which have their Long Island strongholds in these Pine Barrens wetlands, and several kinds of bizarre carnivorous plants including Pitcherplant, Sundews, and Bladderworts that have leaves and roots modified to capture and digest insects to supplement their nutrient intake, restricted by the sterile waters. Floating bog mats also often ring many ponds in the Pine Barrens.

Red Maple swamps generally result from the gradual replacement of bog vegetation by swamp forest, a process which would have long ago resulted in the demise of all of the bogs without the intervention of the same force which prevents the upland Pine Barrens from being overrun: fire. Wildfires often burn down into Pine Barrens wetlands, especially during droughts which lower the water table and water table and expose the peat built up by undecaying bog plant debris in the acid waters. These wetland fires burn everything, including the accumulated peat, to the water table, killing swamp plants

and opening up the peat for recolonization by plants of open bog mats. Thus the swamps are constantly being rejuvenated to their earliest bog stages and grow slowly back anew to mature swamp stages.

Atlantic White Cedar swamps, or "cedar bogs", are specialized swamp communities which usually develop in time between bog mat and Red Maple swamp stages. Atlantic White Cedar, a majestic, columnar, deep green tree that grows in pure stands, is intolerant of shade and gives way to Red Maple unless fires open up swamp stands and allow its seed, which is produced abundantly, to germinate and grow in sunlit conditions. White Cedar swamps once lined almost every headwaters and streamside bog system in the Pine Barrens; now they are quite rare, the best stands persisting along the Peconic River. A rare green butterfly, Hessel's Hairstreak, feeds as a larva only on Atlantic White Cedar and is now almost extinct in the Long Island Pine Barrens.

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Human impact on the Long Island Pine Barrens has been severe, and is increasing, destroying more irreplaceable natural land every year: only about 80,000 acres of the original 250,000 are presently in fairly natural condition. About 20,000 more exist in small pockets generally under 100 acres each. Of the approximately 50,000 acres originally comprising the Oak Brush Plains, only about 2,000 salvageable natural acres remain. The rest has been buried by suburban sprawl, especially over the past thirty years.

The natural lands of the Pine Barrens now face an array of pressures which must be alleviated if this uncommon region with its restricted and sensitive biota is to survive until the end of the century. Development pressures and schemes of all kinds, from government road-building projects to private industry, shopping centers, and housing developments, are impinging on what is left of the Pine Barrens. Even in parks and other officially designated natural areas within the Pine Barrens, sanctioned fire suppression efforts have been so successful over the last few decades that natural fire frequencies have been completely disrupted, resulting in impoverished oak woodlands or devastated former Pine Barrens areas invaded and suppressed by decidious forest or weedy plant species, then finally hit by wildfires so

unnaturally hot that local fire departments could not control them -- fires which destroyed everything, indigenous Pine Barrens wildflowers and invading weeds alike.

While Pine Barrens uplands, generally regarded by an ignorant general public as wastelands, have been destroyed by the square mile, the wetlands, which supposedly rank higher in the eyes of the masses, have not fared well either. Many formerly pristine bog, swamp, and stream areas have been dammed, diked, filled, or cleared. Over 95% of the original White Cedar swamps of the Long Island Pine Barrens are gone, victims of selective clearcutting for shingle wood for over 200 years. Some other areas, while not physically altered, have been destroyed by water pollution, especially nutrient enrichment of groundwater by sewage, septic wastes, fertilizers, and chemical dumping, which enabled non-native aquatic organisms like the Common Reed or Common Cattail to choke out the thousands of Pine Barrens bog and swamp plants and animals that formerly inhabited these wetlands.

If we are to save the Long Island Pine Barrens, we must begin to act now, to convince private citizens and government officials of the values of this largest remaining natural region of Long Island, a region containing many of the rarest, most endangered life forms in the northeastern United States. The Long Island Pine Barrens Society will endeavor to educate the people of Long Island about the existence and value of the living Pine Barrens, and will work with all people who wish to preserve the native biota of this fascinating area.