# LIGHTNING, FOREST FIRES and PEOPLE

**Wildfire Ignitions in the Preservation Core of**

**the New Jersey Pine Barrens**

***Historical Observations and Illustrations***

**Horace A. Somes, Jr. - NJ Forest Fire Service, retired**

**Turtle Creek Neck – Wading River, New Jersey**

**FINAL DRAFT 3/1/22**

**SKIT BRANCH, Wharton State Forest – 2008**

**PLAINS BRANCH, West Pine Plains – 1997**

**CALICO RIDGE, Bass River State Forest – 1997**

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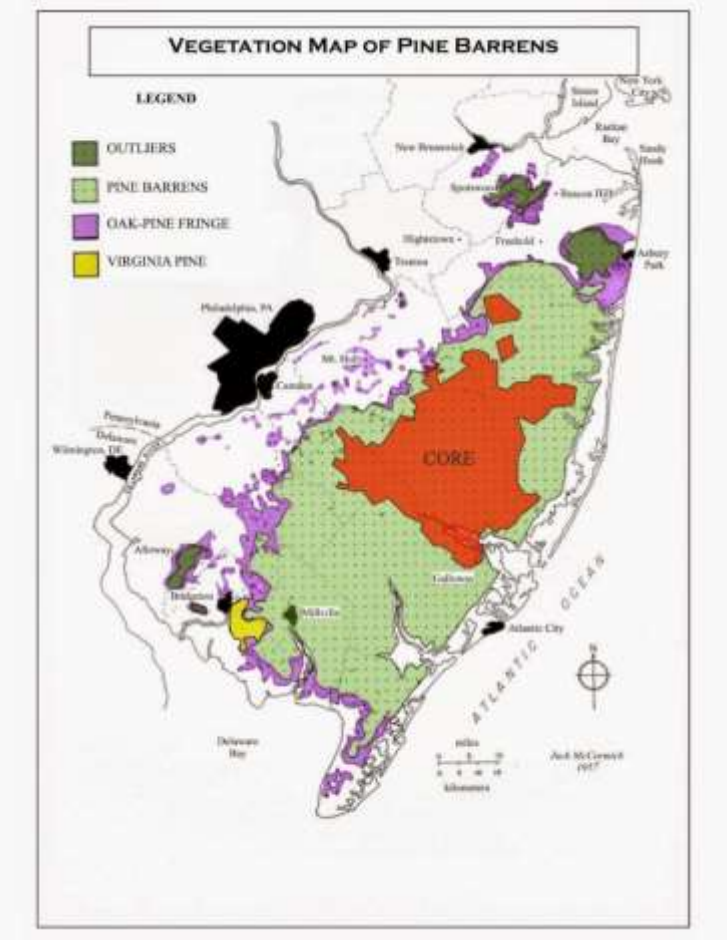
## LIGHTNING, FOREST FIRES and PEOPLE

### *Wildfire Ignitions in the Preservation Core of the Pine Barrens*

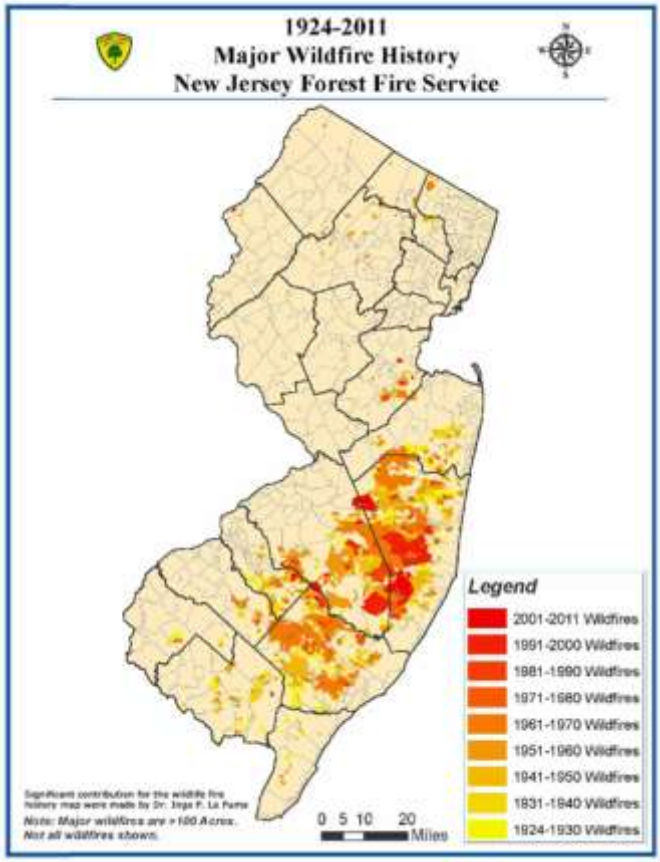
Horace A. Somes, Jr., Turtle Creek Neck – Wading River, New Jersey (NJFFS retired)

3/1/22

Forest fires are a recognized component of the ecosystem within the Pine Barrens of southern New Jersey; however, the cause and effects have varied over time due to different sources, spread behavior and burn patterns. Wildfires also pose one of the two principal natural hazards in the Pineland and shore areas of southern New Jersey, the other being coastal storms – whether the occasional hurricanes or more-frequent nor'easters. Both share a common aspect of human land development and use, and limited perception of the long-term natural hazards to life and property. This could involve the current attention to flood and storm dangers, and rising sea level by those who want to be at the shore and by the sea. Alternately, in the fire-prone Pinelands there may be lack of situational awareness of the dangers by those who want to be in the "Pines" – both to live in and visit for recreation. The looming smoke column on the horizon may appear far away, or not occur in their area or timespan.



The two natural hazards do not share a common timespan element with respect to expectation and advanced warning. Weather forecasting has advanced markedly since the establishment of the National Weather Service. Coastal storms may be tracked for days or weeks in advance, from as far away as the ocean off Africa or as relatively close as the Outer Banks of the Carolinas. Timing is now much improved, but exact tracking and intensity is a future meteorological goal. By comparison, fire weather and danger are cyclic on a daily weather basis and during annual climatic seasons. Depending upon fuel cover, wind, burning conditions and ignition origins, fire spread may involve hundreds of acres per hour and hundreds of feet per minute. A forward rate of spread of the flamefront of approximately a mile per hour may seem unimportant with respect to either driving or walking speed, however the time element is critical with respect to where a fire started, where it is going and what is in its path that requires evacuation or protection. With typical intense fires in Pineland fuels having flame heights to the tree tops and producing embers to cause spotfires a quarter mile further, both time and space become critical for the protection of life and property. When a firefront is visible through the adjacent forest and embers are landing in the yard, it is too late to consider hazard reduction that might have involved pruning lower limbs or clearing leaf litter – to create defensible space for firefighters to defend the property. When dense smoke drift in advance of the fire front chokes breathing and obscures highway traffic, it may be too late to safely evacuate, to have firefighters respond to threatened properties or to have the police alert residents and direct traffic. This now shares common elements with coastal storms, when it is too late to elevate the structure when floodwaters are lapping at the foundation or have covered streets when evacuation is necessary.



Statistics allow for comparison over recent decades and indicate the relative causes and acreage, which are predominated by human ignitions – whether careless, accidental or intentional (NJ Forest Fire Service, 2018 Fire Summary for the agency-protected area of 3.25 million acres):

| | | |
|---|---|---|
| Miscellaneous | 195 # | 145.25 acres |
| Equipment Use | 178 | 82.75 |
| Campfire | 55 | 66.25 |
| Children | 52 | 77.50 |
| Smoker | 48 | 52.25 |
| Incendiary | 43 | 899.50 |
| Railroad | 32 | 9. |
| Debris Burning | 23 | 24.50 |
| Lightning | 3 | 2. |
| Total | 629 fires | 1,359 acres |

Over the years since records were kept in the early 20th century, causes and effects have varied, particularly with regard to yearly and seasonal changes in weather and climate that can skew the data when large catastrophic conflagrations occur infrequently – but with devastating and newsworthy results. The results also can be varied due to the source and timing of ignitions, which can greatly affect statistical numbers – such as a single accidental nighttime ignition from an abandoned campfire, versus multiple arson ignitions to achieve maximum effect in the afternoon spring day. Three decades earlier, the Fire Statistics – 1988 Fire Season were:

| | | | |
|---|---|---|---|
| Incendiary | 764 # | 1,982. Acres | 41.5 % |
| Children | 312 | 233.75 | |
| Miscellaneous | 297 | 803.75 | |
| Smoker | 196 | 184.50 | |
| Campfire | 85 | 117.25 | |
| Debris Burning | 66 | 114.25 | |
| Equipment Use | 58 | 86.50 | |
| Lightning | 18 | 21.00 | 1 % |
| Railroad | 12 % | 11.50 | |
| False Alarms | 31 | n/a | |
| Total | 1,839 fires | 3,554.50 acres | |

The most-recent available numbers for 2020 provide another perspective with regard to cause and effect with regard to number of occurrences as well as total area burned.

| | | |
|---|---|---|
| Miscellaneous | 309 # | 463 acres |
| Equipment | 290 | 190 |
| Campfire | 85 | 157.5 |
| Children | 82 | 40.5 |
| Incendiary | 71 | 2,221 |
| Debris Burning | 69 | 39.75 |
| Smoker | 66 | 30 |
| Railroad | 42 | 28.75 |
| Lightning | 12 | 1,520.75 |

A few preliminary observations are apparent, and have a bearing on the following broader perspective in the core of the preserved Pine Barrens where the broadest expanses now and will continue to remain in the regulated Pinelands Preservation Area. This also is the area where broader and long-term considerations of controlled burning and uncontrolled wildfires are necessary for both protection of life and property, and interrelated management of a fire ecosystem – for which the concept of "natural" is a challenge to define.

- Historic times confirm the relative infrequent numerical occurrence of lightning ignitions in comparison to predominant human causes. But this was the natural source of ignition for the thousands of years, as the last Ice Age waned and the landscape developed from tundra to forested. While few in number and area due to modern suppression capabilities, a single large-scale event may occur as in 2017 when the Penn Swamp fire occurred in a remote area of the Wharton State Forest – but provided an opportunity for a landscape-level combination of wildfire control and ecosystem treatment on a thousand acres.
- By comparison, incendiary fires have been significantly reduced in recent decades, and reflect the enactment of stringent arson laws that now apply to cause-and-effect. Numerically, the occurrence numbers have dramatically fallen due to the apparent combination of conviction penalties for such offenses, and on-going administrative attention to the investigation of cause-and-origin and multi-agency attention to prosecutions. Also in 2021, a single event can have a statistical impact when a single major wildfire occurs – as happened when a suspicious ignition in the Wildland-Urban Interface (W.U.I.) of Bass River Township resulted in the Ballangers fire with risks to life and property. However, there has been a marked decrease in the past malicious fire-setting within the Pinelands and associated wildland cover, in high-hazard fuels, during periods of high fire danger, in remote locations with poor access, with multiple ignition origins, using accelerants, employing time-delay ignitions and/or when other wildfires are occurring. In the past, such situations have had the potential to overwhelm both suppression and protection resources.

"SLOW-MATCH" IGNITION DEVICE USING MATCHBOOKS - TYLERTOWN

- From the standpoint of children-caused wildfires, this was historically a significant cause directly related to "little" people – although not adults. It also received early prevention attention that included *Smoke Bear.* As such ignitions were likely to occur near homes, schools and related play areas, they had adult attention at both governmental and community levels due to proximity to homes, structures and other improvements in what is now termed the Wildland-Urban Interface. From a societal level, this also may reflect the reality of less outdoor "play" and more indoor activity – with cultural perspectives of either "good" or "bad". An old firefighters' anecdote apparently has faded, and an afternoon activity "spike" cannot be co-timed to student let-out from schools or drop-off from buses.
-
- "Miscellaneous" now is a leading statistic, although this is broad, inherently vague and variably defined. It might be termed a "catch-all" for causes that are not separately categorized –

<u>"MISCELLANEOUS" IGNITON CAUSES:</u>

SUSPICIOUS FIRE at REMOTE CABIN that SPREAD into FOREST

HIGHLAND PARK, BASS RIVER

ACCIDENTAL TRAILER FIRE in WOODED PRIVATE CAMPGROUND

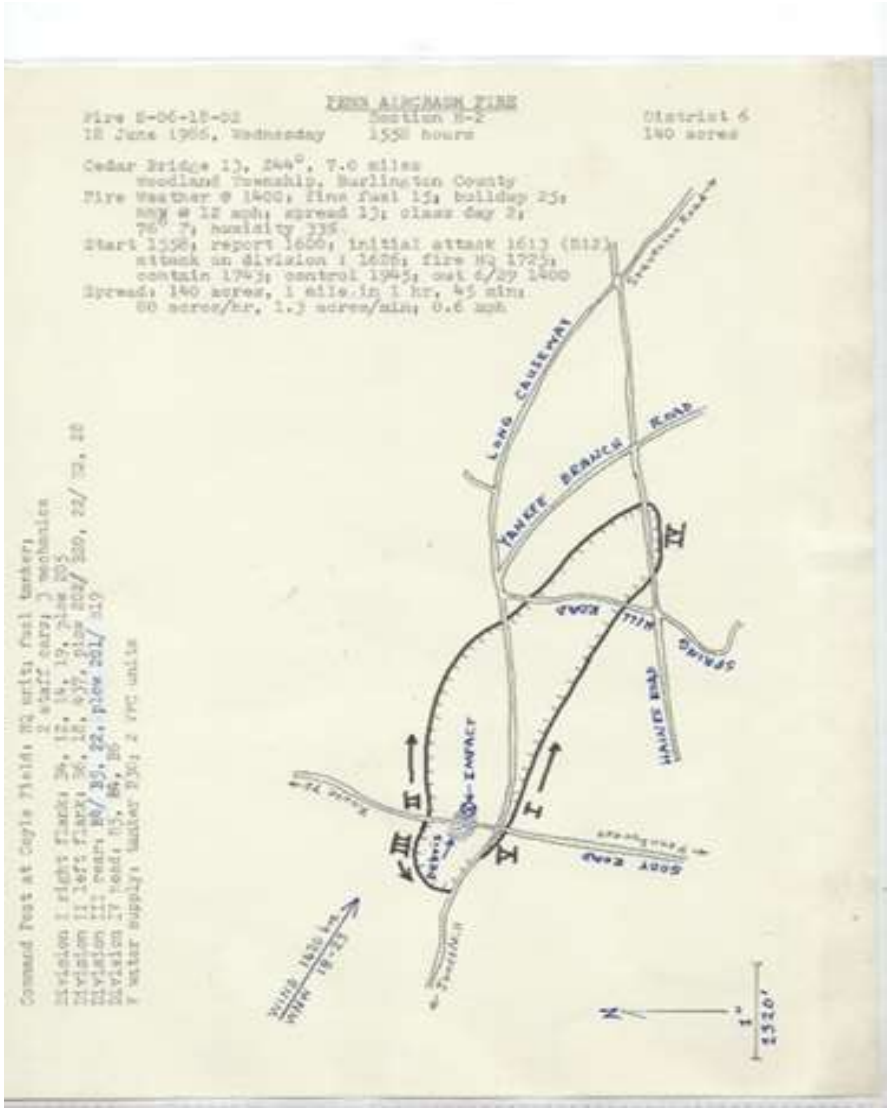
STOVE ASH DISPOSAL in CAMPGROUND WADING RIVER

BURNING of STOLEN ABANDONED VEHICLE CARRANZA, WHARTON FOREST

IMPACT CRATER of F-4 *PHANTOM* AIRCRASH – 1986 WEST PINE PLAINS, BASS RIVER – NORTH RECREATION AREA

REGROWTH in CRATER – 2021 (author in center)

FIRE ORIGIN ADJACENT to SOOY ROAD and DOWNWIND SPREAD (top) from IMPACT CRATER




F-4 WILDFIRE MAP

BOTTLE-ROCKET IGNITION SOURCE for TARGET RANGE WILDFIRE, ROUTE 72, WOODLAND TWP.

SAMPLES of HIGHWAY FUSEES and CHAR at FIRE ORIGIN

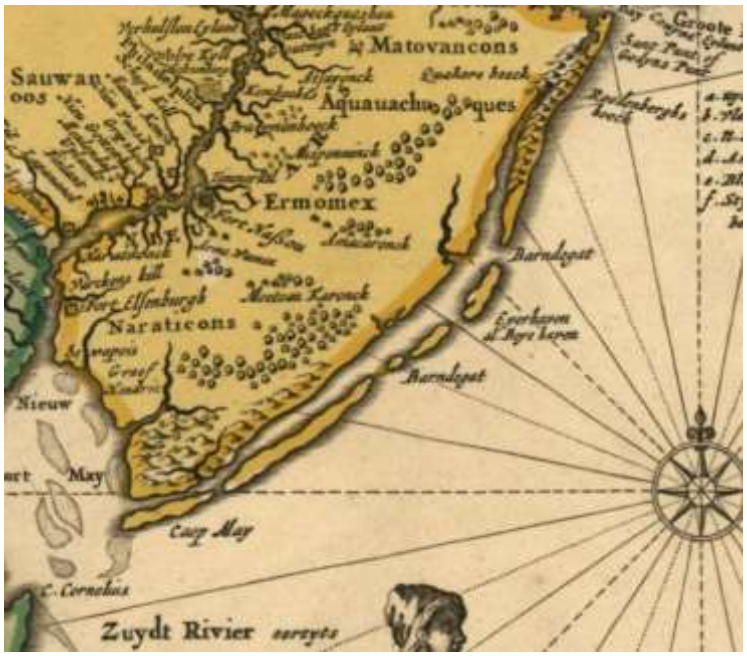


"EMERGENCY SIGNAL" FIRES SET by LOST WOODLAND MOTORISTS

With DISABLED OFF-ROAD VEHICLE, ALLEN ROAD, BASS RIVER

- Human-caused ignitions change over time and with societal culture, as in the case of previously-observed for children "playing with fire." Across the Pine Barrens, railroad ignitions have drastically changed over recent centuries as this mode of transportation has sharply declined in the region – and old wood/coal engines been replaced with diesel-fuel and electrical power. Smokers also have less impact, possibly due to newer self-extinguishing cigarettes when carelessly disposed. Equipment use also has changed, although gasoline-fueled equipment is always subject to malfunctions and accidental fires. However, the early catalytic converters for control of pollution emissions, inadvertently could produce "lava balls" of incendiary particles along miles of highway – which might pass through hazardous forests, or at least along grassy shoulders of flashy fuels. Both campfires and open burning may escape control, that is more closely regulated by administrative permitting – and subject to restrictions or prohibition during hazardous fire weather.

While the past hundred years are a relatively short time-span for the natural and human history of Pineland fires, it does indicate the predominance of human-caused forest fires that extends back historically – particularly in recent centuries since European settlement. This would not have been the case in the Pleistocene when the northern portion of the state was capped with ice and the south was wind and water-swept tundra and shoreline – that was many miles seaward of a lower ocean level. However, as the Ice Age ended and sub-arctic forests returned to the Coastal Plain, fires ignited by lightning would have occurred – much as they continue to do in Alaska and portions of the Canada. While not as numerous as lightning fires are today in the Pacific Northwest or in Florida, they probably would have originated in thunderstorms, which may be enhanced by sea-breeze weather. An interesting perspective for South Jersey, is the geographic axis of the Pine Barrens on the Outers Coastal and the parallel shoreline where the sea breeze originates. Another geographical perspective is that both South Jersey and Florida are located at different ends of the Coastal Plain of sandy soils that stretches from the Caribbean to the Mid-Atlantic. From an ecological perspective, this Plain supports a swathe of pinelands – with fire-adapted Longleaf and Pond Pine in the south, and Pitch and Shortleaf Pine in the north. The pines of the Mid-Atlantic can serve as lightning rods for electrical arcs to ignite fires, comparable to sub-arctic spruce and fir along the western coast – but fortunately without the numbers that may occur along the Pacific or the remoteness of the Alaskan expanse.




TRIBAL NAMES of NATIVE AMERICANS in

NEW NETHERLAND, NEW ENGLAND and PARTS of VIRGINIA

(1685 Nicolaes Visscher (Amsterdam)

Novi Belgii Novaeque Angliae: nec non partis Virginiae tabula multis in locis emendate)


SOUTHERN NEW JERSEY INDIAN TRAILS INCLUDING the “MANAHAWKIN” THROUGH

The CORE of the PINE BARRES and MULLCA VALLEY

(John P. Snyder. 1969. The Story of New Jersey’s Civil Boundaries 1600 – 1968.

NJ Bureau of Geology and Topography, bulletin 67)

The early Paleo-Indians who arrived as the ice retreated and sea-level brought the shoreline much closer, were nomadic but would have utilized fire for both cooking and warmth. Obviously, there is no record of other fire use in this prehistoric period of the last ten to twenty thousand years. However, the subsequent Woodland Native Americans would have occupied a forested Coastal Plain of both pines, cedars and hardwoods. Accounts of early explorers indicated the application of fire to forests and fields for various purposes. Again, prehistoric patterns and effects of such fires and burning is anecdotal. This makes the definition of "natural" fire and effects across the Pinelands a conceptual matter. However, historical accounts and archaeological research indicate predominant settlement on the better soils of the Inner Coastal Plain, with lesser permanence along the sandy soils of the coast. However, as today's travelers to the coast move east-west through the Pine Barrens, Native Americans also travelled between the Delaware and the Atlantic – often along established trails which may later have become stage routes of "least resistance" for colonists and early settlers, but may not have become paved roadways. From a theoretical perspective, fire application and effects would have predominated around settlements and along passage trails. However, lightning then and now would have occurred within the climate, and caused forest fires.

The first explorers of America observed (Blakeless, 1961): *"As the ship came up the Jersey coast (Henry Hudson, c. September 3, 1609) in the early morning, the crew 'saw a great fire, but could not see the land'. At dawn, they made out Sandy Hook…."* Dutch settlers approaching Delaware in 1632 further observed: *"In spite of these piratical perils, they were within sniffing distance of North America by December 2. Eagerly they 'smelt the land, which gave a sweet perfume, as the wind came from the northwest, which blew off land, and caused these odors.' This was not the natural scent of flowers, which others mention. One of the Dutch travelers wrote: 'It comes from the Indian setting fire, at this time of year, to the woods and thickets, in order to hunt; and the land is full of sweet-smelling herbs, as sassafras, which has a sweet smell. When the wind blows out of the northwest, and the smoke is driven to sea, it happens that the land is smelt before it is seen.'"*


"SANDY BARREN DESARTS" (*SIC.)* - 1776

(A Map of the Country Round Philadelphia Including Part of NJ, NY, Staten Island and Long Island, Library of Congress)

Then and now, natural ignitions by lightning would most likely have been associated with the pine trees of the Outer Coastal Plain – comparable to the forests of Florida, far to the south. While the Florida peninsula also has coastal climatic influences from the Caribbean to the west, the ocean influence from the Atlantic to the east may result in sea-breezes that may extend inland across much of the Pinelands. Seasonal occurrence is due to summer thunderstorms, which occur when air temperature is high, plant moisture content has lowered after the spring growth and groundwater levels are lowered – particularly when drought occurs, and organic turf/peat layers become dry and soil moisture and water tables are lowered. Under such conditions, a lightning strike may ignite a fire in the forest – that may burn long and deeply, greatly affecting the plant ecology, wildlife habitats and underlying soils.

PERSISTENT BURNING and TURFING of ROOTMAT at

FRANKS FORD WILDFIRE, WADING RIVER – WEST BRANCH

ATTRIBUTED to RECREATIONAL VISITORS at HAUL-OUT BEACH for CANOES

Observations of wildfire cause and origin from lightning in the core of the Pinelands Preservation area within the Barrens, indicates a predominance of ignitions in the predominant Pitch Pine (*Pinus rigida*). Occasional but far less-frequent fires develop from strikes in oaks, cedar trees and dead snags, which also form less forest composition within the Pine Barrens. This may relate not only to species predominance, but also to physiology and growth habit. The resinous foliage of needles is flammable, particularly when moisture content is reduced during summer heat and drought. Dead needles that fall and form “pine straw” ignite easily and burn intensely, and may involve freshly-fallen needles following fire scorch of the canopy. Needles both living and dead in lower branches that may extend down the trunk to at or near the ground, may provide fuel that allow flames to “ladder” up the tree into the canopy and create a crown fire. In conjunction with leaf litter, groundcover plants and low brush of the understory, this produces a thick fuelbed that typically may redevelop as quickly as five years following either a wildfire or prescribed burn.

PINE “STRAW” ACCUMULATION in BRANCHES Of LADDER FUELS

GROUNDCOVER UNDERGROWTH FUELS of WOODY SHRUBS and NEEDLE LITTER

HARRISVILLE, WHARTON FOREST – UNBURNED SINCE 1930 BATSTO CONFLAGRATION


LARGE, THICK BARK PLATELETS PRODUCE FIREBRANDS and ACCUMULATE at TRUNK BASE with PINE STRAW

The thick bark forms flammable platelets that typically accumulate around the base of the trunk with fallen needles. This may dry out to form a mound of tinder, that is thicker and elevated above the surrounding fuel bed in the groundcover. The tree canopy forms an umbrella that intercepts precipitation, and a tenth inch or more rainfall may be necessary before the water saturates the foliage, runs down the bark and enters the fuels and soils. Consequently, the mounded material at

the tree base provides a dry fuel load that may be readily ignited by the electrical charge that runs down the trunk to the ground. Such ignitions may initially create a smoldering turf fire, that may persist for several days before self-extinguishing or spreading in the surrounding forest fuel as they dry out – producing a wildfire that may occur one or several days after the strike, in the absence of sufficient storm precipitation or additional sufficient water from later rainfall. Interestingly from a wildlife perspective, the native-forest Red Squirrel or "chickaree" may contribute to occasional pine trees with significantly higher "buttresses" of dead organic and flammable materials. This is a result of the squirrels' preference for shucking pine cones for their seeds, particularly where tree or shrub oaks are in short-supply to make acorns for food – in the otherwise "piney" woods of the "Barrens".

In lowlands and swamps of deep, dry turf and peat, such fires may persist for days or weeks after the ignition. Peripheral "pine bottom" outside of the wetter swamps, may offer susceptible "lightning rods" in the form of large and tall pine trees that extend skyward more than the dense, scrubbier pines on the adjacent uplands. Light rainfall may not sufficiently wet the soils and fuels, and persistent burning may occur until a half-inch or more of saturation occurs. Where the turf burn extends into lightly burned forest with undamaged foliage, light rains may produce inadequate water to pass through the canopy and into the ground. This is likely where an upland fire extends into Atlantic White Cedar (*Chamaecyparis thyoides*) swamps where there is a dense canopy that serves as an "umbrella", and thick organic soils may have persistent dryness – until a lower water-table is reached by the combustion. Post-burn conditions may have a lowered ground surface of one or more feet, where the turf and muck were consumed; and the cedar trees may have been killed by root damage and destruction – without flame impingement of the aerial trunk and tree tops.

Reburning of fire areas also may occur when the heat from underground turf is showered by dead, scorched leaves that fall from trees, days after the flamefront passed. This is most likely in pine stands with no crowning but sufficient scorch, to produce an abundance of needle fall. While the above-ground flaming is generally spotty and typically does not produce a spreading front, a smoke nuisance is likely – as well as the risk of the turf burning under or a flaming spark blowing across a control line into fresh fuels. This may be aggravated on extensive burns that produce blackened ash over broad areas that no longer have a canopy cover. The unshielded dark ground will then absorb sunlight during the heat of the day, and produce "dust-devils" that carry aloft the ash, sand and small fuel materials that have been partially burned. This poses the risk that residual burning material will be carried over the line, by a column that may extend to a hundred feet above the ground. Pine-bark platelets may produce firebrands if their fuel content has not been completely carbonized. There may be sufficient combustible content for the bark fragment to continue to burn when aloft, and be carried hundreds of feet or more into the air due to the aerodynamics of the plate.

1977 GREAT SWAMP FIRE on SLEEPER BRANCH, WHARTON TRACT

(NJDEP GeoWeb CIR Imagery)

UNDERGROUND TURF and PEAT REMOVAL in in PINE LOWLAND DUE to EXTENDED BURNING GREAT SWAMP FIRE (Horace A. Somes, SR.)

MOSS and GRASS REGROWTH in PINE LOWLAND of GREAT SWAMP

CEDAR and MAPLE SWAMP with LOWERED GROUND LEVEL of TURF

Behavior of Pineland fires is typically perceived as the massive flame fronts and smoke columns from major incidents that are “front-page” newsworthy. Post-burn conditions may be seen as “match-sticks” of trunks from which the foliage and smaller branches, have been burned off from the crown to the trunk. This image may be inadvertently fostered by necessary suppression activities where flank firing and rear burnouts develop crowning behavior, that resembles the crowning head of the wildfire. Consumption of groundcover growth and fuel beds may burn “down to sugar sand”, exposing the white, coarse materials of the Cohansey layer that forms the top geologic layer of the upland Pinelands. This is typical in an extremely intense flame front that burns “everything in its path” – both forest and manmade; or a long-burning turf burn, that kills both the above-ground plants and their underground roots.

CROWNED BURNOUT FROM ROUTE 72 (foreground) to CONTAIN the SPRING HILL MAJOR FIRE

WILDFIRE SPREAD PATTERN SHOWN in UPPER RIGHT CORNER

(Asbury Park Press: 4/1/2019)

DOWNWIND HEADFIRE BURN of 1999 WARREN GROVE MAJOR FIRE ACROSS

OSWEGO ROAD (right) and SPREAD INTO BASS RIVER (background)

APPARENT SPOTTING from HORIZONTAL-ROLL VORTEX on LEFT FLANK

PRIOR to SEA-BREEZE WINDSHIFT and SPREAD RE-DIRECTION to the RIGHT/NORTHWEST

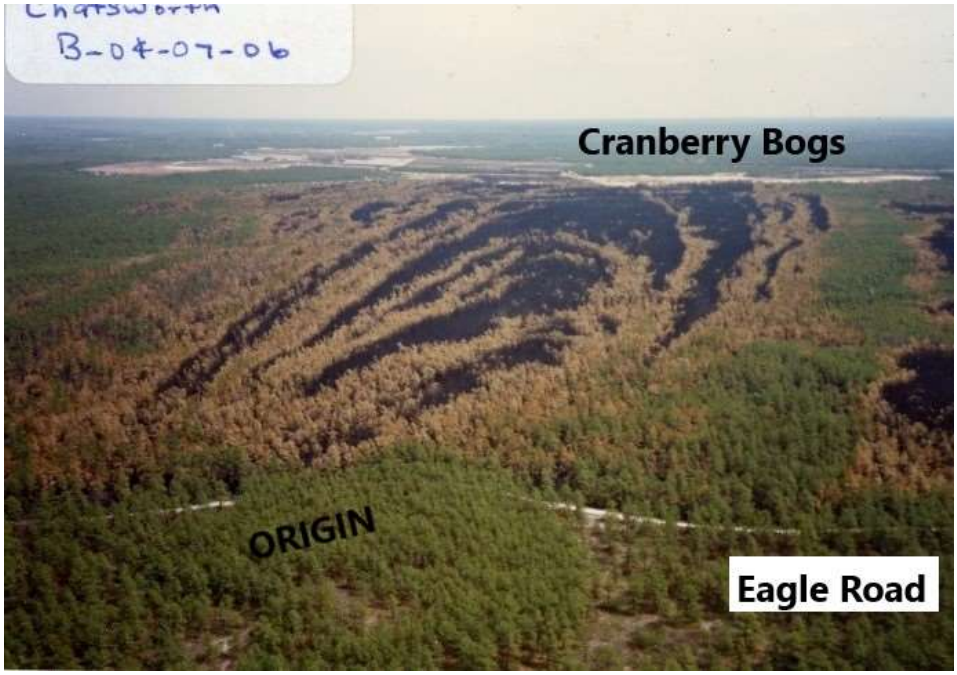
The reality of a fire in a forest, grassland or marsh is that it typically involves spread through the available fuels, in response to prevailing winds. This also creates the geometric form of an elongated ellipse, consisting of:

- Relatively narrow front of most-intense burning at the head, as the fire spreads rapidly with the wind from the origin point of ignition
- Relatively narrow but low-burning perimeter, at the rear as the fire backs into the wind and away from the origin
- Lengthening, connecting flanks on the right and left sides of the fire from the rear origin to the head, with a gradual increase in burn intensity and rate

This pattern may not be apparent where counter-firing with back burns, flank burns or burnouts are necessary to control a wildfire within established lines, whether an existing fuelbreak such as a road or river, or a fireline constructed with machinery or by-hand of firefighters. The total area burned over may be increased by a factor of two or more, higher than the typical wildfire pattern – although intentional firing is often necessary to control the spread within available, established firebreaks – or to protect property exposures, whether constructed development, farmland or other resource values that are at risk.

In the flat-land topography of the Coastal Plain, another weather factor may contribute to fire behavior and spread, particularly where fuels are heavy and prevailing wind speeds are light. Under such conditions, the burn pattern may appear to surge; producing a series of elliptical bands of burning. This occurs when in-rushing air into the body of the fire, carries ember storms outwards. A narrow strip of partially burned forest forms, as the mass of spotfires is created by the embers and

surges back into the main fire. The resulting “crown strip” is typically scorched but not consumed, and the process may be repeated several times – producing a somewhat-concentric pattern. Under such fuel, weather and burning conditions, this may be a driving force in the propagation of large and dangerous conflagrations – other than flamefronts that are solely wind-driven. This process produces horizontal-roll vortices (HRZ), that will continue the fire spread until conditions change: the wildfire is brought under control by suppression efforts, a prevailing windshift causes a dominant spread direction, the fuel hazard is reduced or is exhausted or the diurnal burning cycle reaches nightfall. But in the meantime, the fire behavior in such a fire may be erratic and aggressive, predictably unpredictable and pose profound dangers particularly for firefighters while attacking the forest fire or protecting exposures. Multiple heads may impact and “flopover” a control line in different places at different times. Spotfires may prevent containment of the headfire, particularly where ember storms occur or reach long distances of a quarter mile or more. HRV’s may cause flanks to blowout for a distance, entrapping firefighters who are facing what was a flank and who are now exposed to crowning fire that is pulled into the main fire body – with them and their equipment in between. This has resulted in unfortunate burn-overs with the possibility of fatalities or equipment loss.




1991 EAGLE ROAD MAJOR FIRE, TABERNACLE / WOODLAND TOWNSHIPS:

BURN PATTERN from SUSPICIOUS ORIGIN on EAGLE ROAD (foreground)


SPOTFIRES from DISTANT RIGHT FLANK:

- SHORT-DISTANCE in WOODED ISLAND in CENTER of CRANBERRY BOGS
- HALF-MILE LONG DISTANCE ACROSS BOGS into

FOREST in FOREGROUND

In addition to fire behavior, different fire causes may pose different hazards with regard to origin location, time of ignition, fuel condition and geographic hazard area or fire corridor. Beyond fire use by Native Americans, significant changes or evolutions have occurred since historic record keeping. These have varied from historical anecdotes, to written observations, news stories and to modern GIS mapping and statistical analyses. These may be generally described as follows, in a general chronological order with emphasis on the core Pine Barrens:

- Following colonial exploration, European settlement patterns followed the Native American utilization of better soils and water resources – with colonists and settlers displacing the original inhabitants, occupying prehistoric settlements, utilizing better agricultural soils and accessing natural resources, particularly of coastal and inland waters. Additional land clearing for new towns and farmland would involve forest cutting and burning, with the likelihood of wildfire escapes to the surrounding forest.

OLD BRIDGEPORT and TURTLE CREEK NECK at WADING RIVER:

1903 STATE GEOLOGY SURVEY ATLAS SHEET 32 INDICATING FIELDS, FOREST, SWAMP and TIDAL MARSH

1925 AERIAL PHOTOGRAPH (courtesy of Peter H. Stemmer)

2020 NJGeoWeb IMAGERY INDICATING FIELD RE-FORESTATION

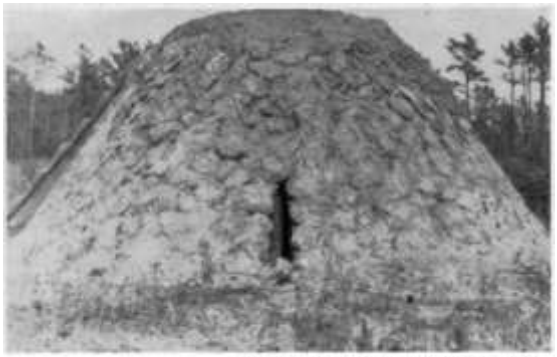
- An account in the September 7, 1838 printing of the New York Herald indicated: *"Dreadful Fire in New Jersey – The fire in the New Jersey woods, we learn from a gentleman who left Bordentown on Wednesday, has increased to a most alarming and frightful extent. Millions of property (SIC.) have already been consumed. A space of 20 miles in length, 11 in breadth, through Burlington and Monmouth counties, and consisting chiefly of pine woods and cedar swamps, is not in a state of conflagration. The clouds of smoke are seen twenty miles off, and at night the air is filled with a lurid blaze which dims the moon. The grass and woods are so parched from the drought that the flames spread with lightning like rapidity, presenting at night a scene of unparalleled sublimity. A great many houses and thousands of cords of wood are destroyed; and it is feared a number of persons, hemmed in by the flames, have perished."*


TRUNK SECTION from REBURNED PITCH PINE
PAPPOOSE BRANCH, PENN FOREST
1982 REBURN ATTRIBUTED to ARSON
HEART-WOOD CHARRING DID NOT PREVENT EPICORMIC BUD RESPROUTING
FROM SURVIVING CAMBIUM and THROUGH BAR
Note: CENTER HOLE from INVASIVE CARPENTER ANTS

- Early land use included timber harvesting for fuel wood, charcoal production and lumber. Beyond the extension of human activity into formerly-unoccupied forest land, small settlements were spread along interior waterways where small sawmills harnessed water power, including that of relatively small Pineland streams. Then and now, structure fires and accidentsoccurred – particularly with rudimentary chimneys for heat and cooking. Although structural fires today pose minor risks of escape to surrounding wildland fuels, a house fire in a now-forgotten Pinelands town would have burned down the home, probably neighboring structures and possibly spread to the surrounding forest. Charcoal production was a significant risk, as it inherently occurred within forested areas, likely utilized native pine trees and necessitated the sought-after controlled combustion and conversion of the wood into the product "coal".

- The industrial era of bog iron resulted in larger communities within the Pinelands, with their own need for lumber, fuel wood and charcoal. Some locations also had glass and paper

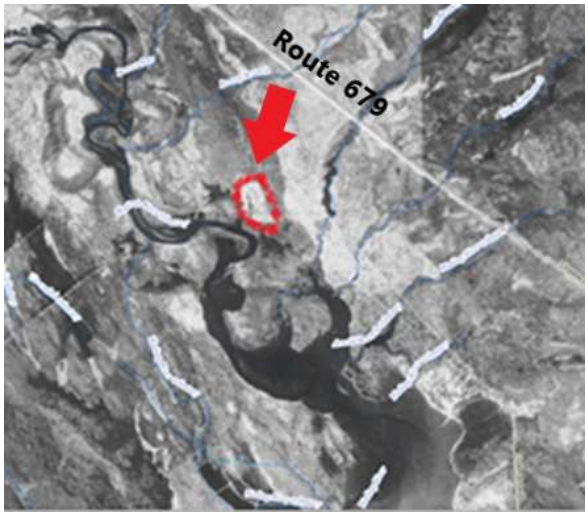
industries, with their own structures and fire risks. This resulted in expanded logging and human presence in Pineland forests that were inherently susceptible to wildfire ignition and spread. Within a community of houses and other buildings constructed of cedar and pine wood, an accident could involve a portion of the town and spread into the forest. Conversely, a distant wildfire could spread unchecked and consume homes and settlements that were miles from the fire origin. And as used by the Native Americans, fire could be applied to fields and gardens – and with the inherent risk of escape, particularly in preparation for crop planting but coincidentally during the hazardous spring fire season.



(Courtesy N. J. Dept. of Conserv. & Econ. Devel.)
CHARCOAL PIT, BASS RIVER STATE FOREST

HISTORIC CHARCOAL PRODUCTION RELIED UPON

PINE TREES from the "BARRENS"




"COALING GROUNDS" ADJACENT to the CHARCOAL LANDING for

SHIPPING COMMERCE on the WADING RIVER

(Photointerpretation by the Author from NJGeoWeb 1930 Imagery)

- A rather different type of resource exploitation also was occurring on the tide marshes that supported extensive cover of short meadow grasses, such as Salt Hay (*Spartina patens*). Early colonists found that these fine grasses could provide pasturage and harvesting for livestock feed and bedding. The early paper industry also could utilize grass fibers, prior to the development of modern manufacturing from wood chips. While the broad marshes along

brackish and saline waters of the coastal bays and tidal rivers were treeless, they did support flammable herbaceous plants that would burn during suitable seasons and low tide levels. It was found that intentional burning would "freshen-up" the growth for either grazing or harvesting. Broad areas were subject to such hopefully-controlled burning into the 20th century, when the haying industry was abandoned. Today on such marshes, a fire ignition would be considered a wildland fire in the natural vegetation – although not a forest fire by definition. In recent decades, the Common Reedgrass – *Phragmites* has become a dominant cover in formerly-natural brackish meadows or on disturbed marshlands. This "grassland" cover in tidelands may produce fuel loads that match those of the upland "pineland" – although subject to variation across the growing/dormant seasons, as well as diurnal tidal cycles of wetness/dryness when burning conditions are aggravated by strong, dry "westerlies" that cause both "blow-out" low tides in the marshland and "class-5" danger days in the pine woods.

SALT HAY MEADOWS of *Spartina patens*

PASTURED and HARVESTED, with HISTORIC WINTER BURNING to

REDUCE TALLER/COARSER REED and CATTAIL GROWTH


PRESCRIBED BURNING of INVASIVE *PHRAGMITES* REEDGRASS

WETLAND ECOSYSTEM MANAGEMENT and HAZARD REDUCTION

1940 SWAN BAY and TURTLE CREEK "HAYING" on MEADOWS with

LANDINGS and BRIDGES (Arrows) for CORDUROYED ROADWAYS

(Photointerpretation of Imagery Courtesy of Peter H. Stemmer)

- As the iron industry of the interior Pinelands was waning in the mid-19th century, a transportation form of industry was developing through the area. Bringing people and materials into and through the forest areas, was considered the next form of development opportunity for the "barrens" – which otherwise had been subject to indiscriminate burning and logging for more than a century. A number of earlier towns became "forgotten" as they were industrially abandoned and at times burned over by wildfires. New communities with land clearing and fire use were begun, in places taking advantage of railway proximity. The ignition risks of embers from wood and coal fired engines, coupled with rolling stock that contained axles, brakes and bearings that could produce sparks, produced a new and significant source of wildfires. The right-of-way alignments of the Central Railroad to the west and the Tuckerton Railroad through the core, were in geographic positions to create a "perfect storm" for wildfires when ignited along the railway and spread with prevailing winds through the core of the Pine Barrens.


SOUTHERN N.J. RAIL SYSTEM

(Wikipedia)


Engine #5, shown above at Tuckerton in 1933, was scrapped in 1940 at Barnegat. (Photo courtesy of the Tuckerton Historical Society.)

COAL-BURNING ENGINE of the

TUCKERTON RAILROAD

JERSEY CENTRAL RAILWAY – ABANDONED

1977 LOCATION of MULTIPLE IGNITIONS from

HIGH CROSSING/WHARTON FOREST to WOODMANSIE/LEBANON FOREST

WHERE NJFFS STOPPED the FREIGHT TRAIN with DIESEL LOCOMOTIVE

ONE IGNITION CAUSED a MAJOR WILDFIRE NORTHEAST of CHATSWORTH to ROUTE 72

RAILSIDE FIRE in GROUNDCOVER FUEL

ATLANTIC COUNTY (NJ Forest Fire Service)

- In the mid-19th century however, the office of the NJ State Geologist started annual reporting of the resource potential and problems of the region – including the extension of the railways. Considerations included improved agriculture with chemical fertilizers, charcoal production, clay works, glass making, salt hay, aquifers, water supplies, drainage, flooding and lumber if the timber could be protected from the pervasive wildfires. The fire problem received attention in the 1890's, leading to the Report on Forest Fires for Season of 1895. It was indicated that *"…Atlantic, and part of Burlington and Ocean Counties…has been exposed to the ravages of fire for many years…On the average, fires are more frequent in Atlantic and Cape May counties. This is, probably, mainly due to the facts that the forest area is large and*

*continuous, and the region is traversed by several railroads over which many trains pass in the course of a day in summer… In Ocean County fires did little damage this year. This is due mainly to the fact that, after the severe fires of the season of 1984, there is little combustible matter left to burn on thousands of acres in the region of the plains and southward to the Mullica river. Fires burned as follows in the pine lands of Ocean, Atlantic and Burlington Counties."*

The following abstracts indicate not only selected causes and damage, but also the extent and variety of human activities:

- March 22 – between Harrisville and Green Bank; timber loss estimated $8,000; 3,000 acres
- Marsh 28 – incendiary; 2,000 acres badly damaged; near Washington Tavern
- March 31– "haymen were burning salt meadows, which is customary at this time of the year, and the wind suddenly shifted, and they were unable to keep the fire out of the neighboring woods; Griscom's Swamp, southernmost corner of Atlantic County; 900 acres
- April 11 – burning brush heap; Estelle 600 acres
- April 18 – "succession of fires for six days; sparks from locomotives"; Elwood; 3,000 acres
- April 19 – "slight fire near Bulltown; attributed to carelessness with tobacco pipe"
- April 20 – "slight fire near Pleasant Mills; attributed to careless smokers"
- April 21 – "cause not known, although rumor has it that an intoxicated man was near the fire when it started"; Newtonville; 1,000 acres
- May 1 – "accidentally set in clearing a safety strip around a cultivated cranberry bog; Cedar Bridge; 2,000 acres, 1 acre cranberry bog, $200 worth fencing and "a large prospective huckleberry and cranberry crop…burnt over to the eastern edge of the West Plains where it was whipped cut (*suppression tactic)* without much difficulty."
- August 14 - "slight fire near Elwood; caused by spark from locomotive; extinguished by section men. About this time there were innumerable petty fires along railroads, most of which were extinguished by section men *(employed by the railroads)*."
- August 16 - locomotive spark; Brigantine Junction; 3,000 acres and "100 cords of wood, cut and ranked"
- August 19 - locomotive spark; 500 acres; "This fire caused occasioned considerable excitement. A strong wind swept the fire at a rapid rate towards the town of Gravelly Run, which was in jeopardy for some time. By back-firing along a road, under the direction of an experienced person, and by hard fighting the houses were saved."
- August 19 - incendiary was convicted; east of Jackson pond to head of Atsion meadows; 1,000 acres and 50 acres of cranberry bogs
- August 23 – accidentally or purposely set by berry pickers; Atsion Road from Hammonton; 300 acres
- August 25 – locomotive spark; Egg Harbor City; 2,000 acres and some cut lumber and rails on Senator Gardner's place near Goose Pond
- September 4 – "supposed to have been carelessly set by cranberry pickers"; Crane Pond near Carmantown"; 1,200 acres "burned everything before it" and large quantity of saw timber

- September 12 – 26-days; clearing land, and unable to control burning turf and brush; Green Bank; 10,000 acres, a few acres of cultivated, and many acres of wild cranberries and huckleberries
- September 14 – workmen burning brush; Bakersville; 4,000 acres and 50 acres of cranberry bogs, destroying the entire crop
- September 14 – feeble-minded man while lighting pipe; 1,400 acres, several acres of cranberry and huckleberry swamps, $500 worth of fencing; a stable, recently-planted chestnut orchard and 100 cords of wood – cut and ranked were saved; "in many places the surface of the earth was burned clean, leaving nothing but stump holes to indicate that trees ever grew there."
- September 15 – slight damage; "set by mistake near Weymouth in back-firing"
- September 22- "set by Italians accidentally while working in the woods near Weymouth"; 2,000 acres and a barn
- October 15 – locomotive spark; "held in check for some time by section men. It was burning in such a way in the swamp land that they were unable to extinguish it"; McKee City; 2,000 acres, Colonel John McKee's sawmill and the corduroy roads into the Gravelly Run cedar swamp; "Old woodmen claim that they have never seen it equaled for havoc. Many trees…tumbled over in every direction, forming large, impenetrable masses of charred timber."
- Season of 1894 (sic.) - careless workmen; McKee City; "…many years ago, it is said, the village was completely destroyed by fire."
- October 22, 1895 – locomotive spark; 5 miles east of Atsion; 300 acres, mostly savanna ground of little value and small pines.
- *"The forest fire season usually begins about the middle of March and ends about the last of October."*
- *"To this list, mainly to show the causes of fires, one due to lightning may be added…did no damage…since the rain which soon followed extinguished it."*
- *"The area devastated by the fires recorded above…amounts to about 60,000 acres."*
- *"Three fires, the causes of which are not at all known, seemed to flare up spontaneously. The contents of a pipe, a lighted cigar stump or a combustible gun wad is probably accountable for the mischief."*
- *"In a region of berries, although perhaps a mystery at the time, it often becomes known later, that the fires were set to improve berry crop…When a land-owner refuses to let people pick wild berries on his property, fires are often started out of spite."*
- *"There are several indications that people have set fire in times past in order to get the job of helping to extinguish it. For years colliers fired the woods so that they could buy the wood cheaply. The charcoal industry, although at one time a very important one, amounts to very little at present in South Jersey. If a man has no money and is out of a job and knows that the owner of the land will pay him for helping to extinguish a fire, it is a simple matter for him to make work for himself."*
- *"Incendiary fires are usually the most destructive, and there is no way in which the cause can be better served than in the conviction and imprisonment of malicious and reckless fire-setters."*
- *"Fires set by sparks from locomotives, although frequent, are generally not so serious for at least two reasons: The land along railroads has been burnt over so many times*

*that there is little food for fire left, and section men usually endeavor to put out fires caused in this way."*

- *"The leading industry in the southern part of the State, the cultivation of the cranberry, has been seriously crippled by fire."*

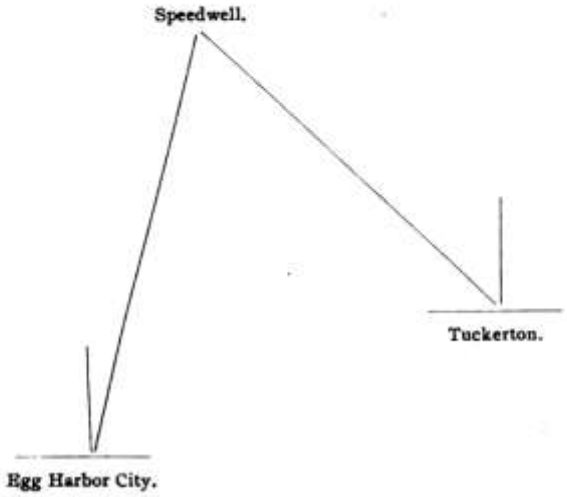
- An ecological study of the Pine Plains during the previous year of 1894, Lutz indicated *"Another fire was described which 'began at Wading River' and burned over 125,000 acres. 'The region over which it burn in Ocean and Burlington counties will be many years in recovering.' Another fire 'began at Woodmasie, probably set by lightning, burned over an area of about 25,000 acres.'"*

- Several years later, the 1899 annual report contained "A Study of Forest Fires and Wood Production in Southern New Jersey" by Gifford Pinchot, who would later lead the US Forest Service. Detailed descriptions accompanied by photographic illustrations, indicated present and better methods of fighting fires, effects, damage and wood production – with particular notes on the silviculture of Pitch Pine (*Pinus rigida)*, Shortleaf (*P. echinata*) and Atlantic White Cedar. An interesting cultural note was the "Moral Effect of Fires on Population", indicating a public apathy to the problem of intentional setting of wildfires:

  *"It is obvious that where the forest is constantly exposed to fire and there is no adequate protection, its value must be greatly depreciated. The result is that the timber is often cut before its maturity. Landowners believe that with proper protection against fire the value of forest property will be greatly enhanced.*
  *The fires have been so abundant that the people have come to look upon them as inevitable, and there is a deplorable lack of real interest among land-owners in regard to any attempt to introduce State protection. Large tracts of land are owned by non-resident capitalists, and timber-stealing is very common, especially after fires. Then the timber is killed many persons consider it better to use the dead trees for cordwood than to allow them to rot on the ground, and they cut such timber on tracts of land to which they have no right. There is no doubt that forest fires encourage a spirit of lawlessness and a disregard of property rights."*

  Pinchot proceeded to recommend a protective organization of foresters, and provided a plan for triangulation of fires from prominent vantage points, reporting via the telegraph system that paralleled the railways and response via railroad and horseback.

with a horse and wagon, for the purpose of conveying the Assistant Forester and any assistants to the scene of a fire without unnecessary delay, and shovels, lanterns, and canvas water-buckets should also be supplied.




EXAMPLE.—A fire breaks out. Tuckerton telegraphs Egg Harbor City that the fire bears directly northwest. The latter replies that the direction from that station is north 21 degrees east. The Assistant Forester at each station at once plots these courses on his map, and each finds that the fire is at Speedwell. The Forester, meantime, has discovered the location of the fire by the same process, the bearings having been wired him at once. He sends his orders by wire without delay, and proceeds himself to Harris station, on the New Jersey Southern Railroad, by the first train. In less than an hour the whole force of the Forest Service within reach of Speedwell may be concentrating to check the fire.

The duties of an Assistant Forester should be to repair at once to all fires within the limits assigned to him, and when there to take entire charge and direction of the efforts to extinguish them until the arrival of the Forester, who should be notified at once by telegraph on the outbreak of the fire. During the season when fires are dan-

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1891 ANNUAL REPORT of the STATE GEOLOGIST

- No changes were implemented, and the 1902 annual report detailed fire # 15: *"May 9th, 1902. Locomotive sparks started a fire near Woodmansie, which burned 75,000 acres, one-third in Burlington, two-thirds in Ocean County. This fire spread in a southeasterly direction to the coast, lasting three days on one wing, and ten days on the other, and burning over twenty miles long and from one to eight miles wide. The little village of Jungs Neck was in great danger of being destroyed. The fire was finally extinguished by rain, after burning some fine pine and cedar timber. No effort was made to extinguish the fire except where it threatened the village of Jungs Neck. Average loss, $1 per acre; total, $75,000."*

- The fire records from the 1904 report included:

    - # 19. July 30 – tramps set fire; Atsion; 300 acres; fought and extinguished by Joseph Wharton's men
    - # 20 – 22. August 5 - three fires undoubtedly incendiary; Atsion; 150 acres of small oaks and pines, brush, barren land and small wild cranberry meadows
    - # 23. August 5 – burning turf on a cranberry bog; Friendship Bog, 5 miles east of Atsion; 300 acres of pine and barren land; fought with sand and shovels
    - # 26. June 15 – farmer burning around his cranberry bog to protect it from fire; Medford; 1,500 acres
    - # 27. October 1 – severe fire between Tuckerton and New Gretna, said to have started at the Green Bush settlement; 2,000 acres; "Some efforts were made to check it, with poor success, and it was practically left to burn itself out."
    - # 28. May 14 – railroad; between Chatsworth and Woodmansie; 800 acres

- However, changes were on the way and the Forest Park Reservation Commission was established in 1904. In addition to the creation of the first State Parks as forestry reserves and for the demonstration of both management and protection, the State Forest Fire Service was established in 1906 and there was a Report of the State Fire Warden. The appointment of Township Firewardens within local communities, was followed by the establishment of Section Foremen from the railroads as additional Wardens. Although this established a system for organization, prevention and suppression, firefighting resources and techniques remained rudimentary – including horseback, shovels, wet sacks and the use of small branches to beat small flames.

INSTRUCTIONS

For Township and District Firewardens.

LOOKOUTS.

Have a lookout or observation tower near your home from which you can see the smoke of a fire as soon as it starts. A tall tree on high ground, with a ladder fastened to it, will serve well. Three or four such lookouts scattered over your district will help you to find a fire. When the woods are dry, watch sharply for signs of fire, and find out what causes every smoke.

HORSE AND WAGON AND SHOVELS.

Have a horse and light wagon always ready in the danger season. The wagon should be strong enough to carry six men. Keep it greased.

If you use shovels in fighting fires, keep them sharp. Have a place for them under cover, and keep them in their place, to prevent loss of precious time when a fire breaks out.

GOING TO THE FIRE.

When a fire starts, lose no time in getting to it. Minutes at first are worth hours afterwards. Go with three men at once rather than wait for six.

Don't wait for meals. Have the meals sent after you and put the cost in your bill.

But before starting, send off a messenger for more men, if you need them. In serious cases telephone or telegraph the State Firewarden.

AT THE FIRE.

Upon arriving at the fire, set your men to work immediately where you are. Then go yourself with all speed along the fire line until you have ascertained the extent of the fire and the general situation. THEN DECIDE:

Where your men can accomplish the most. Whether to send for more men. Whether you need back fire.

PUT THE FIRE OUT!

When the fire is subdued keep a patrol moving along the fire line until you are sure that it is out. Make a lookout tree for him, if necessary, so that he can see above the tops of other trees and catch the first trace of smoke.

In the early morning of the day after the fire watch carefully for smoke, as the dew dries off and the wind springs up.

When patrolling, put out every smoking ember. Run no risks. Spare no pains. Put the fire completely out, then it will stay out.

MISCELLANEOUS.

Prepare a list of "helpers"—men who have agreed to fight fire when called upon to do so.

Carefully keep your badge; wear it when on duty and return it to the State Firewarden when your term of office expires. Take good care of all State property in your possession. The State Firewarden is held responsible for all equipment and keeps a list of all property issued to each warden.

If a fire gets beyond your control, immediately notify the State Firewarden by telegraph or telephone, so that he can summon help "from surrounding townships," as the law provides.

Post these instructions where you can refer to them.

T. F. PRICE,
STATE FIREWARDEN.

1908 ANNUAL REPORT of the FOREST PARK RESERVATION COMMISSION

- The Forest Park Reservation Commission was merged into the State Department of Conservation and Development in 1915, and continued the conservation work of the Commission as well as the resource development of the State Geological Survey – which was incorporated into the Department. The Forest Fire Service continued to evolve, with prevention programs, lookout towers and incorporation of letter carriers of the US Postal Service for reporting wildfires. Firefighting equipment however, remained rudimentary and non-mechanized.

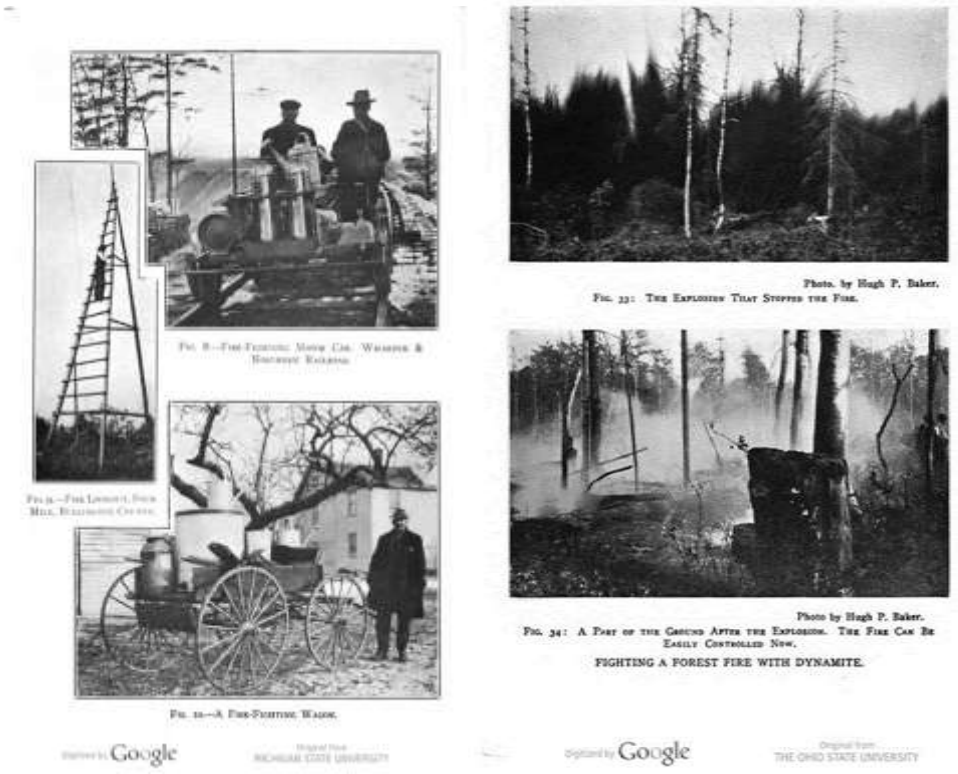


Photo. by Hugh P. Baker.
FIG. 33: THE EXPLOSION THAT STOPPED THE FIRE.

Photo by Hugh P. Baker.
FIG. 34: A PART OF THE GROUND AFTER THE EXPLOSION. THE FIRE CAN BE EASILY CONTROLLED NOW.

FIGHTING A FOREST FIRE WITH DYNAMITE.

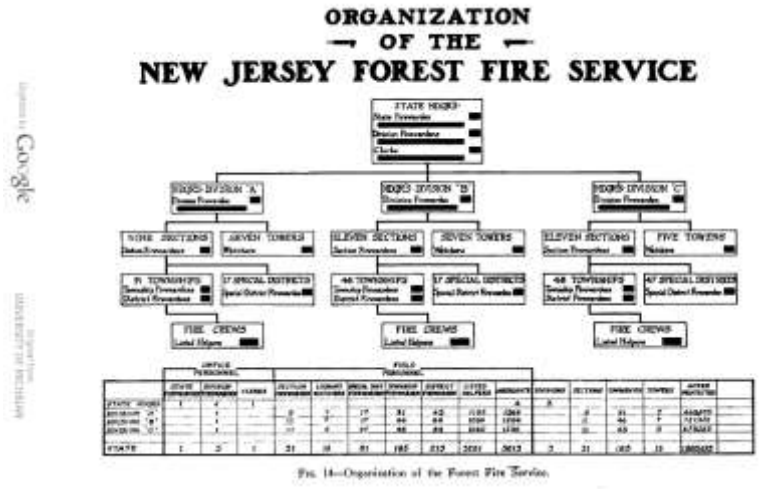
EARLY SUPPRESSION from 1910 (left) and 1913 (right)
(NJ Forest Park Reservation Commission: Annual Reports)

- A newspaper account from the Tuckerton Beacon of June 30, 1921 was headlined *"Towns Threatened by Big Woods Fires/Flames Sweep Thousands of Acres in One of the Biggest Forest Fires Ever Seen Along the Shore. A Close Call for Tuckerton."* The account reflects previous conflagrations in the core of the Pine Barrens:

    - *"raged on a stretch of miles in length in the woods north of Tuckerton all day Friday".*
    - *"Fires in several sections had been burning for three or four days previous to Friday and were not considered dangerous as there had been only a light southerly wind."*
    - *"Early Friday morning a heavy northwest wind developed and within a few hours it was seen that Tuckerton was in danger."*
    - *"Every condition was favorable for it as there had been no rain for several weeks and the woods and underbrush were exceedingly dry."*

- *"The apparatus of the Tuckerton Fire Company was taken to Grassmere on North Green Street and it was only through the heroic efforts of hundreds of men that this section of town was saved, as it was here the big fire came through."*
- *"Several hundred men under the direction of Fire-warden Joseph E. Abbott, put up a gallant fight all day Friday – their work of back firing along the New Bridge road leading to Nugentown, prevented the fire from reaching other sections of the town."*
- *"During the day the fire crossed the Tuckerton Railroad above Greenwood Cemetery and swept the entire stretch between Tuckerton and Parkertown and at the Ball Park, it crossed the main road and went through Price's swamp to the bay."*
- *"A force of men worked all Friday night back firing the old stage road between Tuckerton and New Gretna, to prevent a fresh outbreak of the blaze. This work proved effective and the fire was at this point."*
- *"The fire, which burned over thousands of acres and destroyed an enormous amount of valuable woodland and timber, was hard on wild game and it is said that several young deer were caught. It is thought that many rabbits were burned. All day Friday these animals were seen running before the fire looking for places of safety. A fox was seen near the New Bridge and numerous turtles were found in roads and open spaces."*
- *"It is not known where the fires in this section started."*

- The Forest Fire Service was reorganized significantly in 1924 into a more geographic structure of Divisions and Sections, much as it is today – without the original organization of Township Wardens. The evolution of motorized vehicles during and after World War I was also drastically changing transportation capabilities, although much of the firefighting remained with hand tools and labor – although the tactic of backfiring was now well established for fire control and property protection. Around the actual perimeter of a wildfire, large acreages could be fired-in to control the spread – with wide variation in burn behavior and effects, varying from crowning to light under-burns of the groundcover fuel.




1927 (Annual Report of the Department of Conservation and Development)

FIGHTING FOREST FIRES.

*The Simplest Fire.* The simplest fire is one recently set when the air is still. Such a fire burns in a constantly enlarging circle. Every part is equally dangerous except that the enlarging circle may find more or better fuel in one part than in another. Since there is no wind, there can be no back fire set to oppose the original one, and any attempt to use this method merely makes matters worse. No fire is a *back fire* which does not burn *back* against the wind.

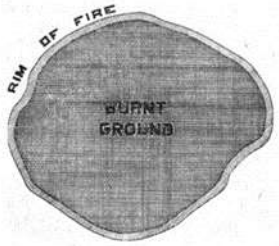



Fig. 17: Diagram of a Forest Fire when there is no Wind.

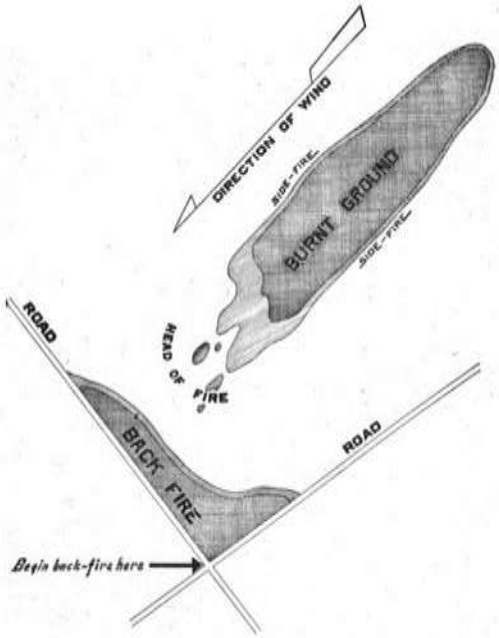
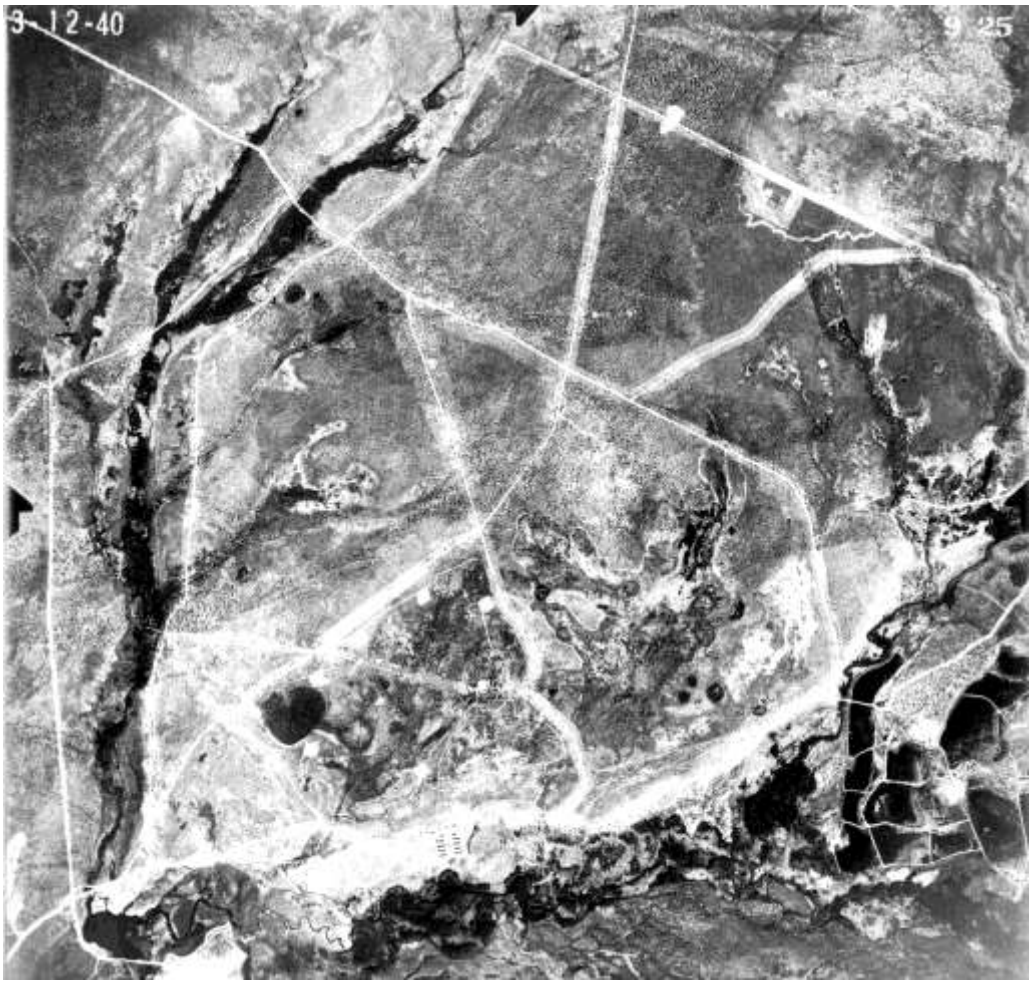



Fig. 18: Diagram of a Forest Fire With a Back Fire Set to Check It.

"FIRE versus FIRE" – 1908/1909

(NJ Forest Park Reservation Commission: Annual Reports)

- The Depression of the 1930's brought an unexpected boost to fire protection with the creation of the Civilian Conservation Corps and camps on State Forests at Lebanon, Green Bank, Lake Oswego and Bass River. This provided personnel, equipment and a command organization under Army direction for not only park development, but also for forest management and protection – augmenting the Forest Fire Service. A tree nursery at Green Bank produced various tree seedlings for reforestation of burned forests, as well as plantations to demonstrate silvicultural possibilities within the Pinelands. It was recognized however, that fire protection was essential not only for the open-space reservations that were becoming established for recreation, but also for the associated forestry demonstrations.



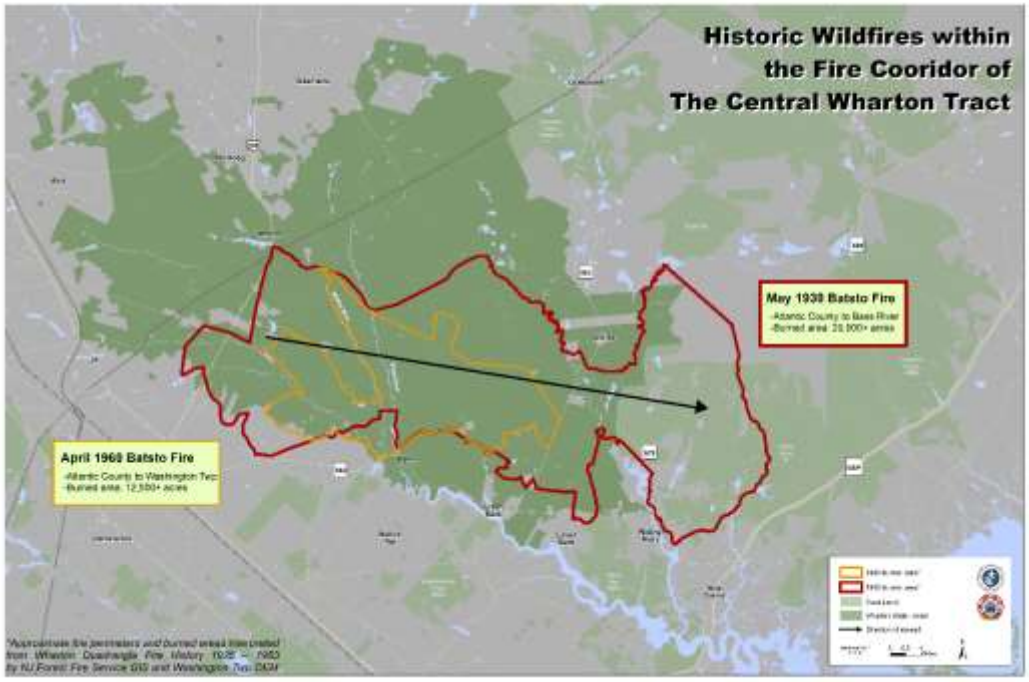

PENN FOREST and C.C.C. CAMP and WORK PROJECTS – 1940

LAKE OSWEGO (lower left) / CAMP BUILDINGS (lower center)

PARK ROADS and FUELBREAKS

(Courtesy of Peter H. Stemmer)

- At the outset of the decade however, major conflagrations occurred – including the Batsto Fire that swept across the Wharton Tract from Atlantic County and across the Mullica, Batsto, Wading and Rivers in May 1930. The town of Lower Bank was protected by a southerly windshift that spread the fire away and northward around the Great Cedar Swamp, which sheltered Turtle Creek Neck on the west side of the Wading River. However, it crossed the mainstem of the river north of old Bridgeport and at Harrisville, as well as the West Branch and Oswego Rivers (or East Branch) between Jenkins and Martha. The fire then spread both north and south as it entered Bass River Township, destroying homes in both Leektown and Allentown, which formerly existed at the old Bass River community on Stage Road.




HISTORIC WILDFIRE CORRIDOR ACROSS the WHARTON TRACT: 1930 and 1960

(NJ Forest Fire Service and Washington Township Office of Emergency Management)

Fortuitously, another major wildfire had already spread southward from Bucto Road in Greenbush on the east side of the Bass River, to Great Bay to the east of New Gretna – but a matter of days before the approach of the Batsto Fire from the west. This approach was observed from the fire lookout tower on Bass River, after the Bucto Fire had been contained – in part by a southerly windshift that turned the fire's direction northward to Munion Field near Warren Grove, although homes were lost at Mathistown along the new Route 9 "concrete" road at the border between Burlington and Ocean Counties. Although control efforts had been ineffective as the Batsto Fire crossed the Wading River near Harrisville, the blackened burn from the Bucto Fire presented a fuelbreak that prevented further eastward spread of the Batsto conflagration that doubtlessly would have reached Tuckerton.

- Although both suppression organization and resources were improving, the inherent risks were proven in 1936 when five firefighters from the Bass River CCC camp and local community were killed in a burnover to the north of Tuckerton and Bass River. Their sacrifice is memorialized at a monument near Stage Road at the north end of the old camp.


MEMORIAL at SITE of FORMER BASS RIVER C.C.C. CAMP

**Memorial Poem Written By Camp Educational Advisor**

---

Dearest friends now gone forever,
Off from earthly care and strife;
Leave us as a gift those virtues,
Which have beautified thy life.

Here alone we mourn and miss you,
Miss you with a brother's love;
And we pray that God will meet you,
When you reach the Gates above.

In the springtime of your manhood,
Here in camp midst nature's beauty;
Came the call to succor humans,
And you answered to your duty.

Gave your all to save the forest,
Building a most noble plan;
God reward your brav'ry fellows,
For you acted like a man.

We shall always love your mem'ry,
When recalled with tear-dimmed eye;
Stanley, John and Ed we miss you --
Fellows, here's a last goodbye.

by
F. William Bates

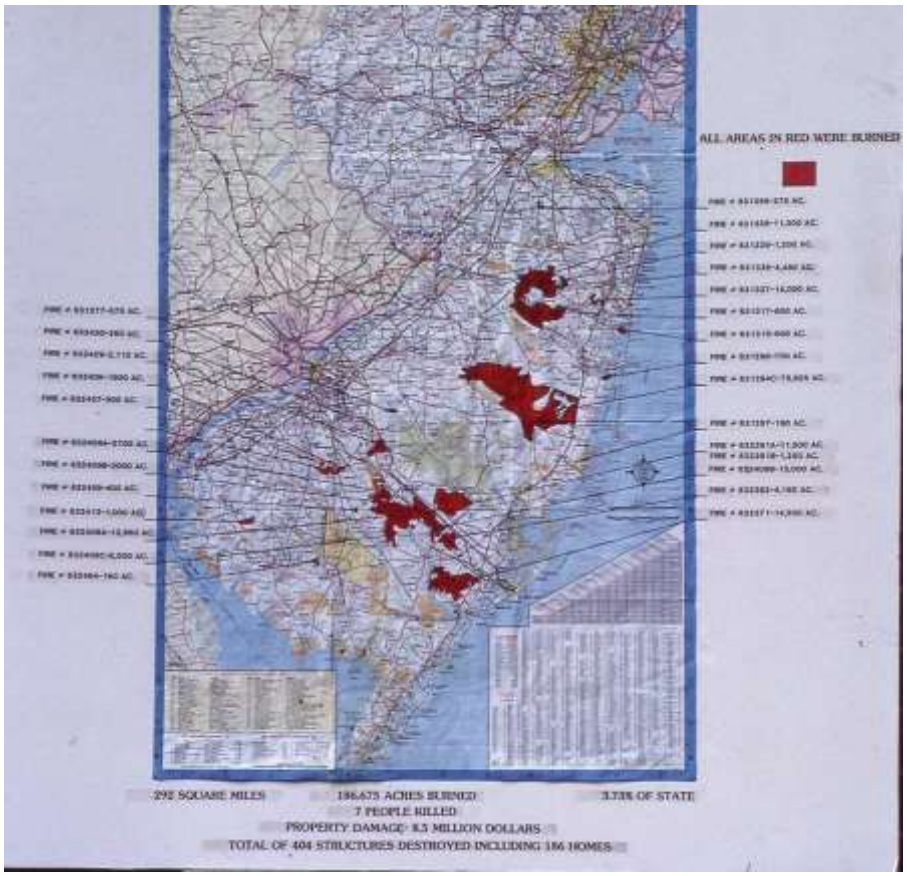
(NJ State Park Service)

- Although fire had been long applied by land and property owners to protect homes, settlements and berry farms in the remote Pinelands, research by the US Forest Service - Northeastern Forest Experiment Station in cooperation with the State Forest Service, had been initiated in the later 1930's for both forestry management and wildfire protection. In

the historic past, the repetitive and severe wildfires had created swathes of burned forest that could reduce and redirect the spread of flames – although natural regrowth could re-establish hazardous fuels within several years. Intentional firing was now applied to selected forest areas in a prescribed and hopefully-controlled manner. The intent was to reduce fuel loading periodically to both reduce tree damage and property risks should a wildfire occur; and coincidentally enhance suppression efforts when a wildfire spread into the prescribed area of lower fuels.

- Suppression operations were considerably enhanced with both motorized equipment, radio communications and air support after the technological advances of World War II. Telephone service was being extended into the remote towns, in conjunction with electrical utilities in the 1920's that brought not only modern conveniences for lighting and cooking – but also the potential for wildfire ignition should a "hot" line fall onto the forest or grassland. Although fire research had been disrupted during the war effort, it was renewed during the 1950's with interdisciplinary research that was expanded to include meteorology, soils, hydrology and wildlife. Application to existing State Forest lands was expanded, particularly at Lebanon where the Northeastern Research Field Station of the US Forest Service was headquartered, as well as Bass River – the first Forest in the Park system. After the State acquisition of the Wharton Tract in 1954, burning was extended to large areas of this newest and largest State Forest of 100,000 acres. State Foresters also assisted forest landowners with planning and implementing prescribed burning, particularly on properties of cranberry and blueberry farms.

- In 1963 however, the continued risk of large-scale conflagrations was demonstrated in the Pinelands, as well as throughout the Northeast when conditions of another "perfect storm" of wildfires occurred. This also was associated with the suburban growth that was expanding across the Pinelands, putting more people and property at risk. Between April 20 and 22, wildfires across the State burned over 100,000 acres due to the enhanced fire danger – with over one hundred homes burned and lives lost. The New Lisbon fire burned more than 74,000 acres as it spread across Lebanon State Forest and into Ocean County. It was attributed to agricultural burning that escaped from berry farms, however wildfires occurred throughout the region and overwhelmed both suppression and defensive efforts.




(NJ Forest Fire Service)


BURLINGTON COUNTY

TIMES-ADVERTISER

COVERS: PEMBERTON, BROWNS MILLS, FORT DIX, WRIGHTSTOWN, VINCENTOWN AND CHATSWORTH

15 Homes Lost in 105,000 Acre Forest Fire

Blaze Seen Largest In Area Since '54

HEADLINE for 1963 NEW LISBON CONFLAGRATION ORIGINATING from

AGRICULTURAL BURNING BETWEEN NEW LISBON and

FOUR-MILE CIRCLE of ROUTES 70 and 72

- However, the 1963 conflagrations heightened awareness of the need to manage fire hazards in the forest, as well as property exposures. A US Forest Service report of the wildfire, indicated the impacts on the Northeastern Forest Experiment Station and its research (Little and Somes, 1963) – which were in the immediate path of the conflagration as it spread from New Lisbon and into Lebanon State Forest. The Station headquarters on New Lisbon Road, was protected however, by fuel reduction in the surrounding forest – that was done frequently and greatly reduced the fuel loading. The post-fire analysis also indicated that "Station studies suffered surprisingly little loss in view of the great area covered by the 1963 fire" on the Forest, which had been subject to widespread prescribed burning for both fire protection and research. A follow-up publication indicated that the April 1963 fires had showed the way to better protection and management approaches (Banks and Little, 1963) – noteworthy of which was prescribed burning to reduce hazards before a wildfire actually occurred.

- The 1970's also brought the spread of the invasive Gypsy Moth across the State and ultimately into the Pinelands – which do contain extensive forest areas of various tree oaks in mixed stands with pines. Introduced in Massachusetts from Europe for the prospective development of silk production from the worms, it had escaped to become a major pest in the hardwood forests – although it would also consume other plant leavers, even including cultivated cranberries in Pineland bogs. Although it would be a negligible nuisance on pine needles if all favored foods have been exhausted, defoliation of oaks has had a long-term and continuing impact on mixed Pineland stands – particularly where oaks predominate or co-mingled with pines. Tree mortality from defoliation can significantly increase the presence of dead snags that aggravate fuel hazard, and significantly complicate both fire suppression and hazard reduction with prescribed burning. As the forest canopy is opened, the growth of groundcover shrubs can be enhanced to increase fuel loading. Seedlings from the pine trees also can become established in canopy openings, and initially form an understory – that ultimately become additional pine trees, changing both stand composition and fire hazard. This creates an enhanced risk for prescribed burning, not only due to the fuel hazard change but more significantly for burn control and mop-up – with critical risks to personnel and equipment when snags and branches fall after burning through.


PINE UNDERSTORY and DOWNED SNAGS in FORMER OAK-PINE STAND

(Tylertown, Wharton State Forest)

OAK SNAGS from GYPSY MOTH DAMAGE

BULLTOWN W.U.I. and

WHARTON FOREST

“WIDOW-MAKER” TOP of OAK SNAG

and SOURCE of FIREBRANDS

from DEAD BARK

DEAD BARK SLABS PRODUCE FIREBRANDS and

ALLOW “CHIMNEYING” of FIRE UP DEAD SNAGS

DEAD SNAGS REQUIRE DIFFICULT and HAZARDOUS FELLING, and

MOPUP AFTER BOTH WILDFIRES and CONTROLLED BURNING

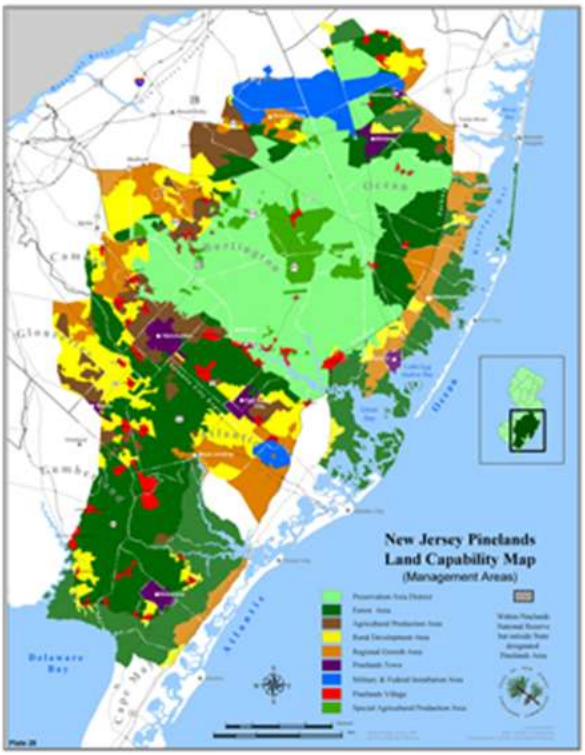
BURNT SCHOOLHOUSE ROAD, WHARTON FOREST BURN of

PROTECTIVE BUFFER for TYLERTOWN

Although not an introduced foreign insect, spread of the Southern Pine Bark Beetle into the Pinelands has also impacted some forest stands – with increased tree mortality and available understory fuels. Although a more-recent forest infestation than the Gypsy Moth, the beetle continues to spread northward naturally in response to global warming – although to date in the Pinelands it has not spread as widely as the “gypsies” on a regional basis. Over the course of this century, there may be an interesting parallel between human control-efforts for the Bark Beetle’s natural extension, and the earlier efforts to stop the spread of the introduced Gypsy Moth. However, both have and will affect the Pinelands forests into the future – and coincidentally wildfire hazard and management.

- The latter 1970's also brought the Pinelands Protection Act, with the Comprehensive Management Plan including recognition of wildfire danger and mitigation – including Fire Management Standards. While this is primarily directed at the regulation of future development, the matter of existing rural development, suburban exposures, regional berry agriculture and expanded outdoor recreation remains in this fire-prone ecosystem. It also sets a Preservation standard for the core of the Pine Barrens, where there also is the largest extent of publicly-owned forest in not only the Reservation-successor State Forests and Parks, but more-recent Wildlife Management Areas. Although Nationally managed open space largely follows the coastline with Wildlife Refuges, several inland and active military facilities also exist – notably including the Warren Grove Target Range in the East Plains, as well as the multi-functional Joint Base that now spans Army and Air Force facilities (formerly organized separately as Fort Dix, McGuire Air Force Base and Lakehurst Naval Air Station.)


1910 ANNUAL REPORT of the STATE GEOLOGIST

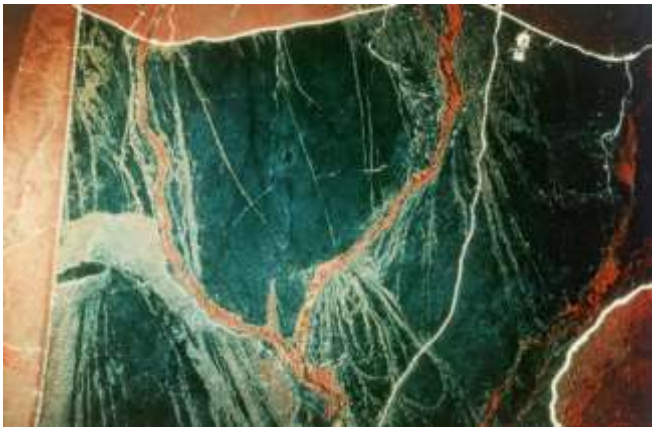



PINELANDS COMMISSION

- Although the 1977 Bass River fire might not be considered a conflagration from the areal perspective, it was a significant disaster with the loss of four firefighters and their engine in the attack upon the fire spread and attempt to protect the Lake Absegami Recreation Area – which was in the immediate path of the headfire. Several points of consideration include:

    - The forest area had been within the eastern section of the 1930 Batsto conflagration, which had spread across the Wharton Tract and into Bass River.

- The location was a relatively short distance from the scene of the 1936 fire in Ocean County in which six firefighters were lost during the C.C.C. era. Coincidentally, both losses are memorialized on the State Forest near Lake Absegami.
- The cause was attributed to an incendiary origin of intentional fire-setting – which has been recognized as a major cause of Pinelands fires since the 19th century.
- Although there were no structural losses, the fire burned into the camping area of the State Forest and threatened an adjacent private campground – both of which required public evacuations. More recently, the Bass River extension of the Batona Hiking Trail from Batsto on Wharton State Forest, was aligned through the regrowth forest from the 1977 fire – and in close proximity to the scene of the fire engine burn-over and fatalities.



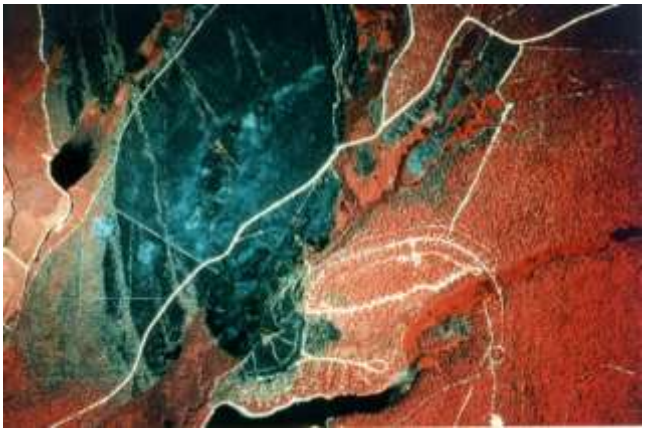
CIR IMAGERY of NORTHWESTERN SECTION of BASS RIVER FIRE with FATALITIES

ORIGIN and INITIAL SPREAD from ALLEN ROAD (elliptical control line, left of center) and

ACROSS COAL ROAD (right of center)

BURNOUTS from OSWEGO ROAD to the NORTH (top)

PUSH-LINE ROAD BACKFIRED to CONTAIN LEFT FLANK (lower right corner)



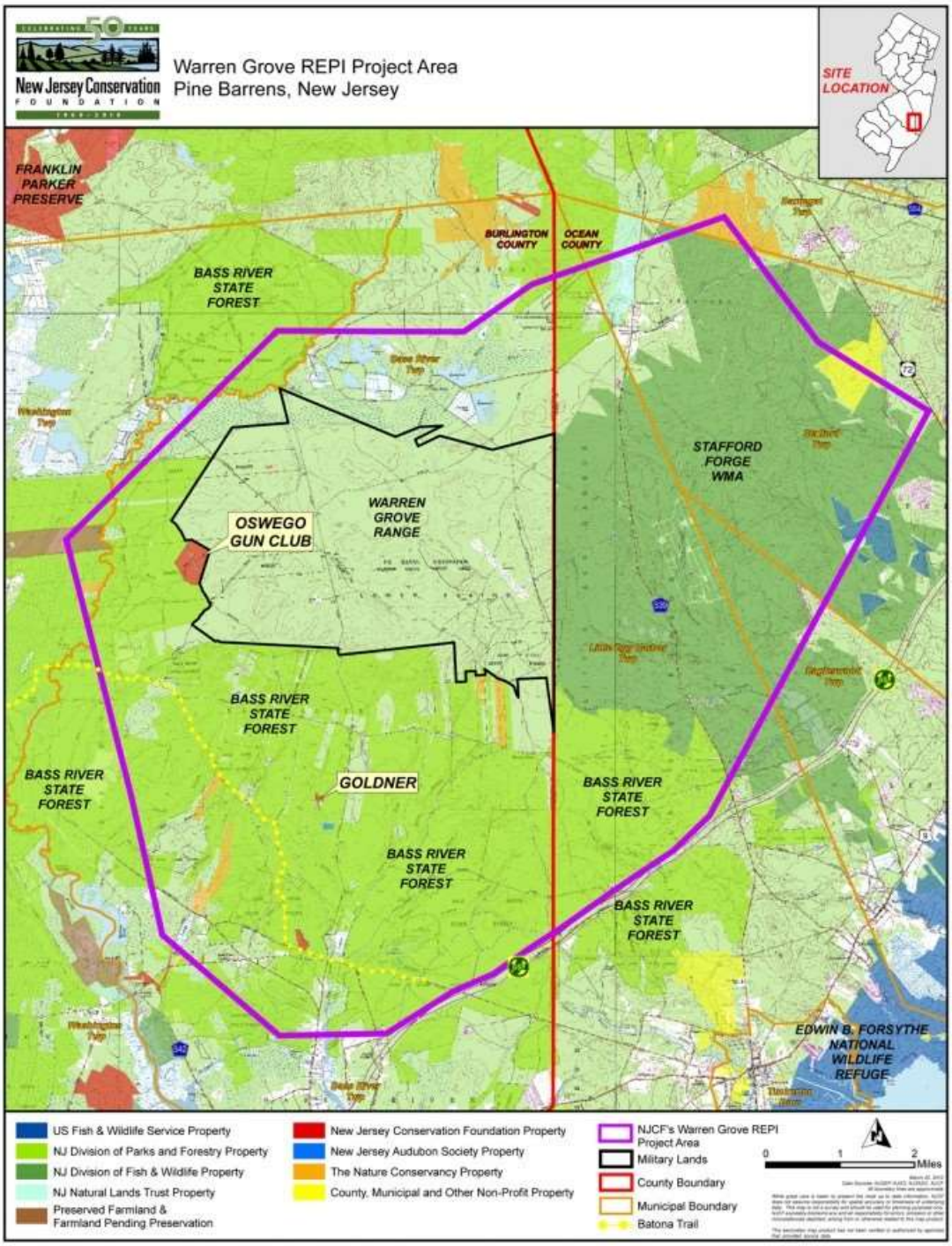
BASS RIVER FIRE SPREAD ACROSS COAL and DANS BRIDGE ROADS into

LAKE ABSEGAMI RECREATION AREA (bottom)


EAGLESWOOD FIRE COMPANY MEMORIAL

BASS RIVER PARK OFFICE

- Coincidentally in this Pineland core, the Warren Grove Bombing Range had transitioned from a US Navy facility of World War II, to today's active training range of the US Air Force and NJ Air National Guard. The range had become increasingly active in the 1970's, but with fire ignitions caused by various munitions within the extremely hazardous Barrens of the East (or Lower) Plains. Gunnery with tracer ammunition, air-to-ground rockets, practice (or "dummy") bombs with spotter charges and flares released by aircraft at low altitudes could start fires both on the relatively-small range, as well as adjacent forests of the State Parks and Wildlife Management Areas. Occasional accidents also could occur in the surrounding pinelands, with a 1986 air-crash near Penn State Forest resulting in a major but not catastrophic fire. In conjunction with the occurrence of several major fires, an integrated program of firebreak lanes and prescribed burning was instituted, in coordination with the State Forest Fire Service. However, a 2007 conflagration that spread eastward to communities and the Garden State Parkway, resulted in a change in military operations to eliminate potentially incendiary devices. Continuation of the prescribed burning program remains the most cost-effective technique to reduce fuel hazards both on the range, and on neighboring State open-space that also are fire-prone. Coincidentally, it also provides an unusual opportunity in the on-going research and application of controlled fire in the Pine Barrens ecosystem, in cooperation with the Forest Fire Service, US Forest Service and research scientists.



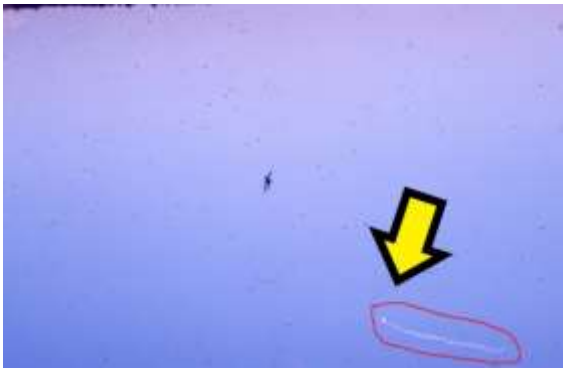

WARREN GROVE TRAINING RANGE and ADJACENT STATE LANDS

(New Jersey Conservation Foundation)

WARREN GROVE TARGET RANGE

1999 WARREN GROVE MAJOR FIRE SPREADING INTO BASS RIVER TOWNSHIP, LEEKTOWN and BASS RIVER / WHARTON STATE FORESTS

1999 B.D.U. (BOMB DUMMY UNIT) and IMPACT HOLE IGNITING LEAF LITTER – 1999 STAFFORD FORGE WILDLIFE MANAGEMENT AREA



AERIAL FLARE RELEASED from A-10 WARTHOG as COUNTERMEASURE for ANTI-AIRCRAFT FIRE

STATIC DISPLAY of STRAFED A.P.C. (ARMORED PERSONNEL CARRIER) and SAMPLES of ORDINANCE

- In the second half of the 20th century, outdoor recreation had grown in the open space of the Pinelands, on increasing public lands, properties of non-profit organizations, private campgrounds and other recreational businesses. In part, this led to the support for the Pinelands National Reserve, Pinelands Act and commitments of funding for "Green Acres" and the acquisition of additional open space. This also had some unanticipated consequences for wildfire management in wildland areas that are relatively remote in the otherwise populous State, but are also fire prone. Visitation expanded into hiking trails through the Pines, at State Parks and across more remote forested land. Visitation also expanded onto Pineland streams for waterway recreation using canoes and kayaks. Off-road motoring on unimproved woods roads as well as all-terrain motorsport events through trails and forests, placed people in remote areas where fire ignitions could occur accidentally or carelessly, and resulting wildfires could pose serious life-safety risks. While such fire incidents remain relatively low in number, their remoteness poses challenges to both wildfire and public safety entities.

FRANKS FORD FIRE at HAUL-OUT BEACH
On WADING RIVER-WEST BRANCH

CIGARETTE IGNITED PINE-NEEDLE LITTER
and SPREAD into RIVERBANK FOREST

- Intentional setting of incendiary fires remained a leading cause, which had been a concern a century before when Pinchot cited the "moral effect" of wildfires. This took a sharp turn when serial arsonists attracted public and political support for a change in the State's criminal laws. The actual series of events and investigations, led to an upgrading of the State Arson Law to provide for the presumption or consideration of jail incarceration for conviction of setting forest fires. This led to the sharp reduction in arson fires as statistically documented into the 21st century.

MULTIPLE ORIGINS at 1991 COLONY MAJOR FIRE
ALONG WOODS ROAD NEAR FOUR MILE

MULTIPLE IGNITIONS with ACCELERANT
at EVANS BRIDGE, WHARTON FOREST


TIRE TRACKS at VEHICLE TURN-AROUND NEAR FIRE ORIGIN - WASHINGTON TURNPIKE, WHARTON FOREST

MULTIPLE PAPER MATCHES at ORIGIN TYLERTOWN – 1986

- Changing aspects of technology and equipment also have factored into changing wildfire causes and statistics. A predominant cause more than a century ago, has gone as the railways that crossed the Pinelands for people and goods are generally gone – with the exception of the limited passenger and freight service on the old rights-of-way to the shore. In a different transportation form, highways with motor vehicles now cross the Pinelands, much as the Native American trails connected from the Delaware Valley to the shore. Fires from equipment use are now a higher statistic and may include exhaust emissions. This has been aggravated when emission-controls fail, particularly with catalytic converters which may produce sparks and super-heated embers if they fail. This may involve tell-tale ignitions on a single side of a roadway hundreds of feet or miles, which may end either when the engine fails or the vehicle leaves the road. Fortunately, such fires tend to be quickly noticed and reported by other motorists, located on grass-covered and mowed roadsides with little fuel and easily accessed and controlled by firefighters. However, in remote areas of unmaintained woods roads and substandard bridging, firefighter access and response may be complicated where increased off-road and ATV traffic have affected passage – in the absence of needed repairs and maintenance by land-management agencies.

FIRE IGNTION ATTRIBUTED to PARKED VEHICLE on SHOULDER of ROAD with PINE-NEEDLE LITTER, RED ROAD, PENN FOREST

ILLEGAL COLLECTION of MOUNTAIN-LAUREL BUSHES for LANDSCAPING

Ignitions from other statistically “miscellaneous” sources of fire may include structural fires, as well as electrical arcing and fires from transmission lines. Structures nestled in forest fuels may not only be prone to wildfire, but also are particularly susceptible due to proximity of landscape trees, foundation shrubbery and lawns of grass and leaf cover that have not been maintained for defensible space. Where the clearance of trees and branches has not been maintained from energized wires of transmission lines, electrical arcing may follow annual growth extension, high winds and storm-downed trees. Suppression operations may be hindered by safety considerations for firefighters if the electrical equipment remains energized.

PENN FOREST ELECTRICAL LINE WILDFIRE:

UNMAINTAINED RIGHT-of-WAY Near PAPPOOSE BRIDGE

FIRE IGNITED by DOWNED WIRES near LAKE OSWEGO ROAD

MAIN BODY of FIRE – LAKE OSWEGO ROAD

SPOTFIRE into PENN FOREST

ATTRIBUTED to THEFT of COPPER from GROUND WIRES on POLES

ARCING WIRE at TRANSFORMER

LOVELAND LANE, NEW GRETNA

BROKEN CROSS-ARM INSULATOR

FACTORY ROAD, CHATSWORTH

BROKEN INSULATOR at ORIGIN

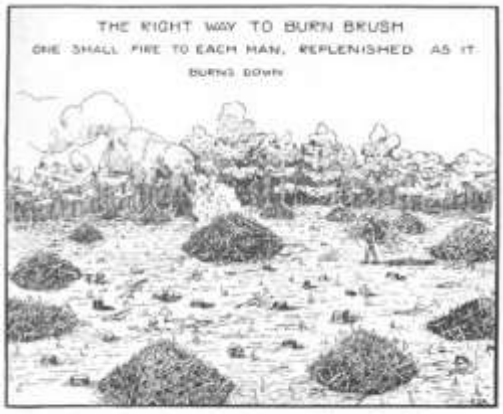
DOWNED WIRE at ORIGIN

Although not separately ranked, the use of fireworks appears to have proliferated in public use in recent years. Comparable to military munitions, these are incendiary by design as many devices are essentially rockets – with inflammatory propulsion and explosive pyrotechnics. While allowed for permitted public events under safety precautions, other use is comparable to open fires and burning without the necessary permits.

- Prevention of accidental and careless ignitions by children and smokers has been increasingly addressed by fire and law enforcement agencies to the extent that human nature and behavior can be addressed. Beyond the increased penalties for arson fires, increased attention has been given to public education and investigation of fire cause and

origin. Again, as with roadside fires, ignitions in or near communities may be promptly discovered, reported and responded to. And with the proliferation of cellular phone technology, prompt reporting has been enhanced to dispatch centers with the implementation of locatable 9-1-1 addressing in recent decades. However, a significant incentive for the prevention of careless or accidental ignitions remains as the long-established statute in the State Forest Fire Law for the recovery from responsible persons or parties of the costs of suppression, which can vary from minor amounts to hundreds or thousands of dollars. This may be in addition to any civil actions for damage to property of owners.

- Administrative regulation of campfires and debris burning has reduced fire ignitions from legitimate permitted sources, which have resulted in major fires in the past – such as the New Lisbon mega-fire of 1963 that involved agricultural open burning at a wrong time and in wrong places. Fire-danger prediction has improved with weather forecasting, and allows for administrative restriction of both campfires and open burning when fire danger becomes dangerous. As with other aspects of human behavior, this cannot preempt inappropriate campfires without permits or illegal debris burning. Modern communications technology of cellular phones and internet have also contributed to enhanced public awareness when fire danger conditions develop, and communication of restrictions to fire permittees – whether recreational or agricultural.




1916 PREVENTION POSTER for "OPEN BURNING: RIGHT and WRONG" (Forest Park Reservation Commission: Annual Report)

AGRICULTURAL OPEN-BURNING by NJFFS PERMIT WADING RIVER TREE FARM (Barbara Somes)

ILLEGAL DEBRIS BURNING SPREAD to FIELD
BEAVERDAM ROAD, WARREN GROVE

ILLEGAL ABANDONED CAMPFIRE
MULLICA RIVER at BEAVER POND
WHARTON FOREST

ABANDONED RIVERBANK CAMPFIRE at
1987 EVANS BRIDGE MAJOR FIRE
WADING RIVER-WEST BRANCH, WHARTON FOREST

RESIDUAL CHARCOAL BRIQUET IGNITING
LEAF LITTER NEAR "EXTINGUISHED"
CANOER'S CAMPFIRE

- Beyond fire suppression and hazard reduction, prevention has long been a key component of wildfire management. Public information through educational posters, have been developed by the US Forest Service and at the State levels. The Smokey Bear program for public education and awareness has been a hallmark for fire safety for over half a century – although at inception the name was Smokey The Bear, and has been followed by other animal icons (Sparky Dog , Woodsy Owl and McGruff the Dog) for public educational programs primarily directed at children. However, as environmental awareness, education and protection was advancing, the Smokey message of "Prevent Forest Fires" was debated with respect to ecosystems and species that were dependent upon fire, and the reality that there were fire hazards and spread corridors that continued to exist and pose risks to life and property – although there had been advances in fire equipment, tactics, organization, detection, reporting and communications that were far beyond the comprehension of the contributors to the State Geologist's annual reports in the latter 1800's. Fire also had been present in different geographic areas, in different forms and with different effects on different forest, scrub and grass land across the continent. The Smokey message was evolving to one of "Prevent Wildfires" to emphasize safety from unwanted fires in the forest

– without infringing upon prescribed burning for the management of both the forest environment and hazards.


NEW JERSEY'S LAW FORBIDS SETTING

FOREST FIRES

LA LEGGE DEL NEW JERSEY PROIBISCE IL METTER

FUOCO AI BOSCHI

NEW JERSEY ÁLLAM TÖRVÉNYEI TILTJA

AZ ERDŐT FELGYUJTANI

מיער אין די וועלדער

STAN NEW JERSEY PRAWA ZABRANIA ZAPALAĆ

LASOWE OGNIE

Fig. 22: Wherever this Poster is Seen a Permit is Required to Make Fire Near the Woods.

1914 MULTILINGUAL PREVENTON NOTICE of FOREST PARK RECREATION COMMISSION

DUE to the INFLUX of IMMIGRANTS as AGRICULTURAL WORKERS

- The prevention message also was evolving beyond prevention of ignitions, to prevention of losses through hazard mitigation. Controlled burning under prescription has been a key tool for over the last half-century, and continues to be applied primarily to pubic open space – with lesser acreages on private lands. This has shaped the fuel and forests on certain lands, however far greater acreages have been shaped by long-term fire exclusion due to the general success of modern suppression. Comparison with historic photographs and descriptions of the “Barrens”, indicates that forested areas – unless developed with structures and pavement, now have larger trees and associated hazardous fuel loads. Forested areas also have become subject to far less of the historic harvesting by logging, which also affected the landscape. Historic land development and use is now re-considered as the Wildland-Urban Interface (WUI) – in part due to the continuing catastrophic losses in western states. In the geographic context of southern New Jersey at the northern end of the coastal plain and pine belt, this interface may be better described than “urban” and broadened to include suburban exposures, intermixed areas of forest and structures, agricultural lands and intermixed areas of forest and outdoor recreation – both at fixed facilities and in remote wildlands.

- At the turn of the century with enactment of fire prevention measures, attention was given to the railroads that had contributed significantly to wildfires during the latter 1800’s. Although the preventative regulations were short-lived, suppression costs were applied to operations such as the Tuckerton Railroad that crossed the center of the Pine Barrens. Although this cause has abated in the Pinelands, to the north where heavy freight activity to the Raritan Center industrial complex and railheads, it is possible for diesel engines to ignite railside grass fires. Other than mechanical issues with brakes and bearings, long-idling motors between shipments, can result in the buildup of carbon in exhaust systems. Hot particles then can be discharged when the train is assembled and the engine leaves the

siding under heavy load. In the future, precautions may be appropriate if the recent restoration of the long-abandoned Jersey Central line results in renewed heavy freight to Woodmansie on the east side of Lebanon Forest, where mining pits may provide raw materials from the Barrens sands for the contemplated railway tunnels to Manhattan.


HISTORIC WILDFIRE HAZARDS along RAILWAYS:

- (left) LOCOMOTIVE HAZARD in COALING – 1916

(NJ Department of Conservation and Development, Annual Report)

- (right) RAILROAD with FUELBREAK, BROWNS MILLS – 1910

(NJ Forest Park Reservation Commission, Annual Report)

FIG. 4.—DIAGRAM OF RAILROAD FIRE LINE CONSTRUCTED ON LEVEL GROUND ACCORDING TO CHAPTER 74, LAWS OF 1909.

1909 STANDARDS for RIGHT-of WAY MAINTENANCE

STATUTE LATER OVERTURNED by LEGAL ACTION

(Forest Park Reservation Commission: Annual Report)

As fire management moves into the 21st century, twin perspectives exist beyond the prevention message directed at ignition causes. Prevention of losses through hazard mitigation is similarly applicable to forests and other wildlands – when compared to hazard mitigation along the coast due to coastal storm and rising sea level. Twin and inter-related approaches exist for mitigation through management:

- Continued and evolving application of controlled fire under prescription to complement wildfire control strategies and protect life and property in the wildland interface, and
- Controlled and evolving application of burning under prescription for complementary environmental and forestry management for the Pinelands ecosystem.

A challenging and difficult component of the decision-making exists for the definition of what is wanted for the forest landscape. While the Pinelands Comprehensive Management Plan has established benchmarks through planning and zoning controls for development and use, less-defined is the future management of inter-related forestry, fire, wildlife, water, species-specific and other ecological considerations. Difficulties arise from the perception of current conditions as affected by several centuries of human-dominated wildfire causes and origins. Over the most-recent century, there have been the additional dimensions of wildfire suppression and controlled fire application. However, beyond the consideration of the fire ecosystem, there remains the over-reaching need for the protection of life and property from a natural hazard.

Human causes of fire in forests remain predominant, either by wildfire ignitions or controlled burning. On-going and expanding research is providing insights and guidance in a variety of fields, including weather, fuels, fire behavior, safety and the ecosystem and its variety of niches. However, the natural cause of lightning ignitions warrants consideration as it prehistorically, historically and currently remains the only non-human cause of fires and effects. While not as numerous as the Coastal Plain fires of Florida, such fires during the summer pose the possibility of sustained burning over days and weeks. This also presents the likelihood of persistent smoke emissions over the time period; particularly as underground turf combustion is likely when there is spread into lowlands and swamps.

Such fires prehistorically would have spread variably in natural patterns with variable behavior, over the course of the forest fire. As weather conditions changed diurnally and over different days, direction and extent also would have changed until effective natural fuelbreaks were encountered or significant rainfall occurred. Some fire perimeters would die out and self-extinguish, while heading fire would continue to burn most intensely. When spreading in underground turf, the effects would have been highly variable – with the possibility of extreme landscape alteration from root and turf destruction, deforestation into scrubland and habitat change to meadows and bogs. When head fires spread with intense behavior across uplands, turf consumption and tree girdling could expose the sandy soils as a favorable seedbed for serotinous cones to open and dense pine seedlings to develop into dense even-aged stands – which are locally termed by firefighters as “dog hair.” Such pine stands may be initially relatively resistant to fire ignition and spread due to dense shading, absence of shrub undergrowth and limited turf buildup. Such conditions would persist in the re-growth, until natural thinning returned the stand to a more open canopy, with undergrowth and buildup of a fuelbed that would re-establish hazardous conditions and wildfire potential.

PINE BARRENS “BURN DOWN to SUGAR SAND”

1982 THREE BRIDGE FIRE, STEVENSON ROAD

WEST PINE PLAINS

RESPROUTING of SCRUB OAK

*Quercus ilicifolia*

BASAL SPROUTING of ROOT-COLLAR BUDS

SPROUTING of EPICORMIC BUDS through BARK

BRANCH with UNOPENED SERTINOUS CONES from

MULTIPLE GROWING SEASONS

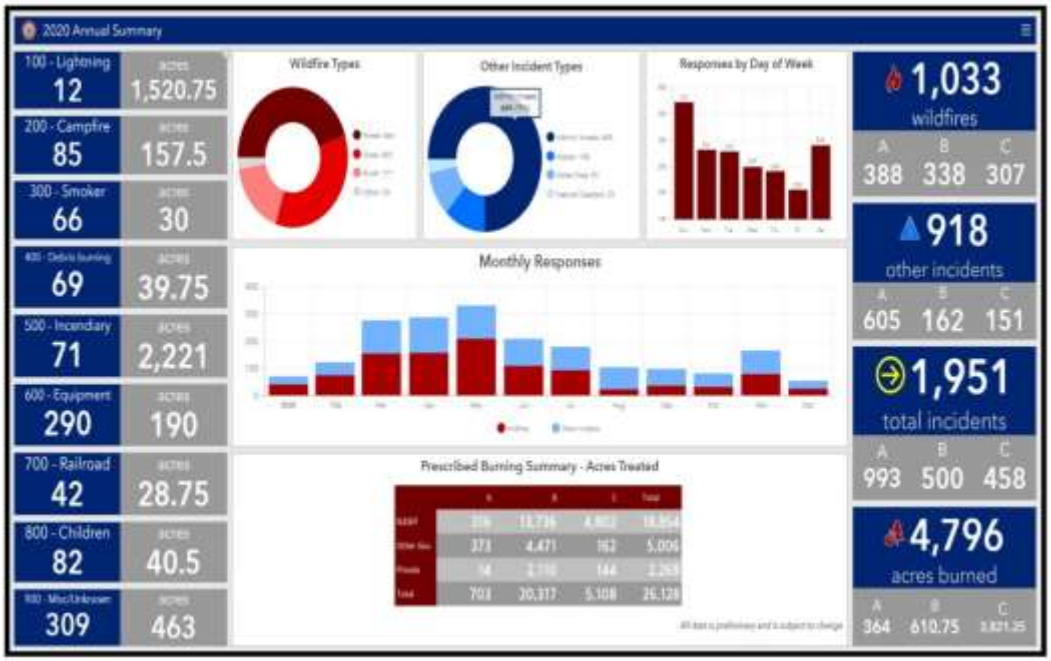
FIRE-OPENED CONE with SEEDS

On-going research includes the consideration of growing season burns from late spring and into the summer – outside of the current regulated burn season of mid-fall to the end of winter. This could attempt to resemble a more-natural regime in which lightning fire was a prehistoric component. However, this will entail the development of the needed fire weather, burn behavior and operational parameters – which have been established over the decades of dormant-season burns

as currently practiced. Ultimately, safe and controlled applications must exist, with the increased consideration of smoke management, nuisances and air quality impacts of persistent burning.

Observations of recorded lightning ignitions in the core Preservation Area of the Pine Barrens, have been collected over approximately four decades. Geographically, this spans the administrative areas of Forest Fire Service Sections B-2 and B-4, with immediately adjacent portions of B-1, -3 and -5 within Burlington and Ocean County. Spatial plotting indicates the distribution across this region, and the location of natural fuelbreaks that would have ultimately contained the natural spread of such fires. Considerable research in new directions will be necessary to translate such forest fires into modeling of cause and effect for the replication of such natural burns. However, it offers possibilities as to controlled burning techniques for prescriptions that are beyond the current practices and parameters.

Current fire activity in this decade indicates the patterns of predominant human ignitions and infrequent, but cyclic summer lightning ignitions. Many more strikes occur both within and adjacent to the paths of the summer thunderstorms as they cross the Pine Barrens. Most storms as they pass, drop numerous “bolts” that may strike both trees and as well as man-made structures – including buildings, towers and utility poles. Lightning ignitions of trees and wildlands is relatively infrequent, as indicated in the most recent, published fire statistics for 2020 – which do indicate 12 fires Statewide. None have been reported in the core study area since the major 2019 wildfire in Mordecai Swamp, which was a short distance from the previous large fire in 2017 at Penn Swamp Branch.




(NJFFS Firewardens Emergency Directory – 2021)

A noteworthy recent human ignition caused the Spring Hill major wildfire during 2020 in the remote Pine Barrens of the West Plains, and originated at a well-established “party spot” for RV (recreational vehicle) visitation on the prominent overlook into Penn State Forest. No major WUI risks were present in this undeveloped portion of the Bass River – North Recreation Area, although a burnover did occur at a site-remediation area near Route 72 and Sooy Road where there had been a

past practice of hazardous-materials disposal in the “Barrens”. There was no apparent damage to the monitoring facility for the pollution plume in the groundwater beneath the sandy surface. A significant impact however, did occur on the nearby north control line that utilized the State highway for backfiring to control the northward spread of the headfire. Firefighting operations required the closure of State Route 72, which is a major highway connecting the Philadelphia metropolitan area with Long Beach Island of the “Jersey Shore”. Another long-range and inter-State impact from a meteorological perspective, was the resulting drift of the smoke plume far-aloft. This extended over the metropolitan area of New York and Manhattan Island – far distant from the Pine Barrens of southern New Jersey.

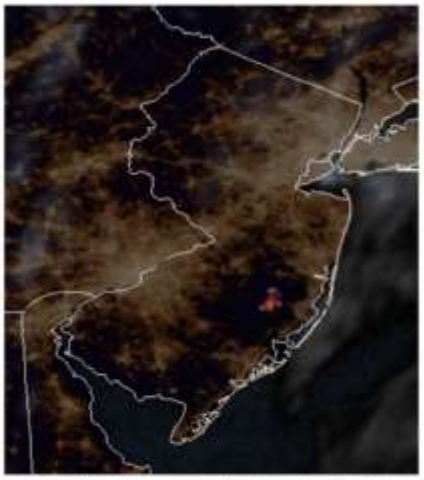
ORIGIN AREA of SPRING HILL MAJOR FIRE 2020:

SPRING HILL OFF-ROAD ORIGIN

(NJDEP Press Release: 4/1/20)

INITIAL FIRE SPREAD FROM the OVERLOOK

(Courier Post: 4/11/20)



The red and gray dots represent the location of the wildfire in New Jersey as seen from a satellite at 4:22 a.m. EDT March 31, 2019.

SPRING HILL FIRE LOCATION WITHIN the STATE of NEW JERSEY

(Wildfire Today: 3/30/19)

NEW YORK’S MANHATTAN SKYLINE WITH SMOKE DRIFT

(Gary Hershorn: Wildfire Today, 3/31/19)

It is recognized however, that the Pine Plains within which the incident occurred, is an ecosystem of the Pine Barrens that has long been shaped by fire. The three recognized areas are dependent for their “dwarf” growth upon periodic burns and have been particularly recognized in historic and on-going research: West or Upper area, East or Lower, and the intervening Pine Plains near Warren Grove. The fire spread with a southerly wind through various previously burned areas, although the northwestern portion had been unburned since a 1946 wildfire spread from Chatsworth into Ocean County – with a more-typical northwest wind direction and southeast spread pattern.

VISTAS BEFORE the 2020 WILDFIRE:

SOUTHERN VIEW into PENN FOREST

WOODS ROAD through WEST PINE PLAIN To the NORTH

Most recently, a wildfire of suspicious origin started adjacent to the Bass River community of Offshore Manor, and spread to threaten a major WUI exposure of Little Egg Harbor in adjacent Ocean County. This burned through an outlying tract of Bass River State Forest which was the southeastern portion of the 1930 Batsto-Harrisville-Bucto conflagration. Although prescribed burning for hazard reduction had been conducted for decades within the State Park, none had been feasible in the immediate fire area due to the geographic complexity of the public lands in immediate association with residential suburbs that interfaced with wildland forests. While control and protection work was successful in preventing losses, the potential existed for both greater hazards and risks, had the event occurred during the more-typical hazardous weather conditions and wildfire behavior of the spring time. Highway traffic again was disrupted on the State’s coastal highway – Route 9, which formed the southern control line where backfiring and burnouts occurred. This affected not only the normal heavy traffic through this region of the shore, but also firefighter access and public evacuations.


FIRE MAP and W.U.I. EXPOSURES at RISK

BASS RIVER and LITTLE EGG HARBOR TOWNSHIPS

NJFFS FIRING OPERATION

NIGHTTIME BURNOUT OPERATION

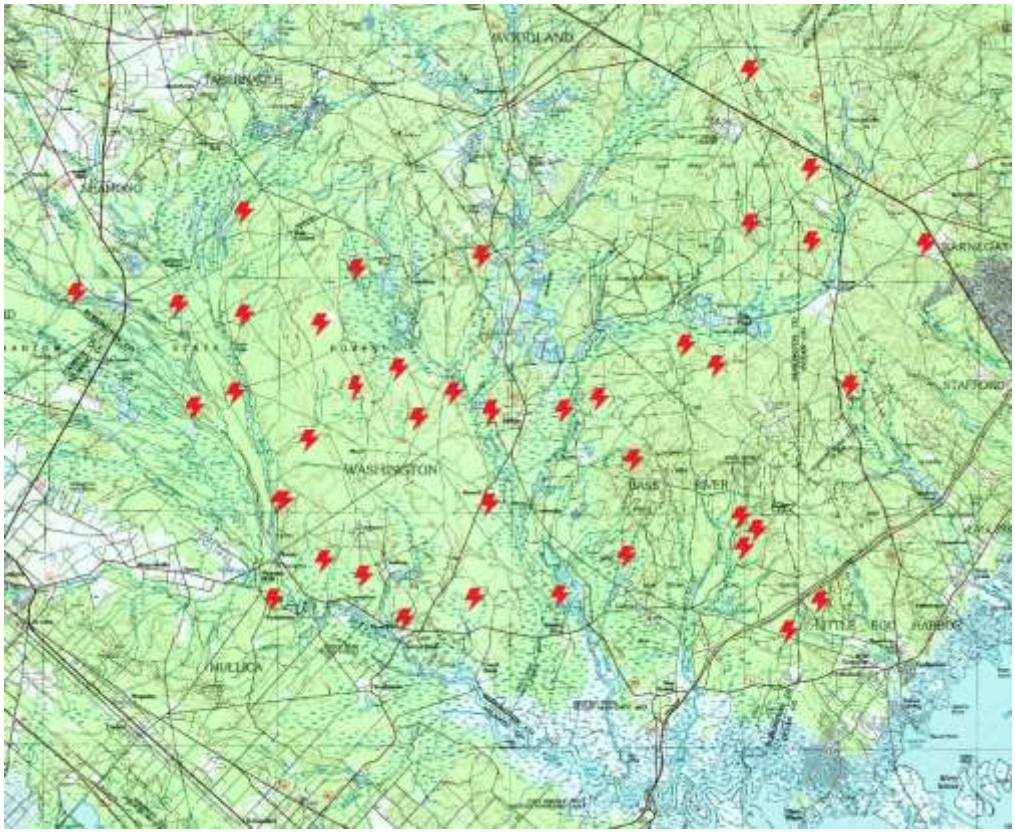
(NJ Forest Fire Service)

In the meantime, the Pinelands that have been subject to both human and natural sources of wildfire, and remain to be subject to further evolution of burning that must be prescribed and controlled – both for hazard reduction to protect the varied WUI of the region, and for treatment of the fire ecosystems within the Pine Barrens. This reflects the threefold challenges of fire management within the small but populous State within the northeastern metropolitan corridor, which contains the unique Pinelands Preservation Area:

1. Protection of life and property from wildfire through suppression and defensive operations, whether the ignition is of human or natural origin.
2. Hazard mitigation before wildfires occur, through prescribed and controlled burning to reduce and modify fuel cover to enhance suppression operations and improve exposure defensibility – in conjunction with physical modifications through forestry activities and landscape management.
3. Prescribed, controlled and safe burning for management of those elements of the Pine Barrens ecosystem that have fire dependence, and have evolved and exist with the fire effects from natural strikes of lightning – that extend back prehistorically, and from the historic and current predominance of human ignitions that vary from accidental to careless to intentional fire-setting.


2020 REGROWTH in the LITTLE PINE PLAINS NEAR WARREN GROVE –

A DECADE AFTER THE LIGHTNING IGNITION OF THE 2010 MAJOR WILDFIRE



OBSERVATIONS of LIGHTNING IGNITIONS: 1976 to 2020 in the

CORE of the PINELANDS AREA

## ABOUT the AUTHOR

NJ Forest Fire Service (retired) – Special District Firewarden

Professional affiliations:

Society of American Foresters

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- Burlington County Animal Rescue Team

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Lifelong resident whose interests include natural and human history of the Pinelands and Jersey Coast.

Past employment in environmental consulting business, tidelands delineation for NJDEP Environmental Analysis and various State Parks and Forestry capacities.

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Business partner with brother Frank in Wading River Christmas Tree Farm

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## REFERENCE LITERATURE

Air National Guard Jet Crashes, 2 Injured in Bailout over Pines (Courier Post, June 18, 1986)

America as Seen by Its First Explorers – John Blakeless, 1961

April 1963 – Can it Happen Again? – Joseph Hughes, NJ Forest Fire Service (New Jersey Outdoors)

Between Two Fires, a Fire History in Contemporary America – Stephen J. Pyne, 2015

Browns Mills Men Burned; Crash Kills 1, Hurts 21 (Burlington County Times – Advertiser, April 14, 1963)

Controlled Burning – Its Broader Ecological Aspects – John E. Cantlon and Murray F. Buell, 1952 (Bartonia, no. 26)

Ecological Relations in the Pine Plains of Southern New Jersey – Harold J. Lutz, 1934 (Yale University School of Forestry, bulletin 38)

The Ecological Role of Prescribed Burns in the Pine-Oak Forests of Southern New Jersey – S. Little and E. B. Moore, 1969 (Ecology, vol. 30, no. 2)

Facts and Figures About Fuel Management with Prescribed Fire in the New Jersey Pinelands, Review of Figures from Publications of the Fire Research Program of the USDA Forest Service, Silas Little Experiment Station, New Lisbon, NJ – Kenneth L. Clark, n.d. unpublished

15 Homes Lost in 105,000 Acre Forest Fire – Blaze Seen Largest in the Area since ’54 (Burlington County Times – Advertiser, April 24, 1963)

Fire in America, a Brief History – Stephen J. Pyne, 2001

Fire in the Pinelands – Robert Somes, n.d. unpublished

Fires Cut Tourism More Than Timber (Atlantic City Press, August 24, 1977)

Five People Die in Ocean County, Forest Fire (Atlantic City Press, 50 Years Ago This Week: May 25 to 31, 1936)

Florida’s 1990 Prescribed Burning Act, Protection for Responsible Burners – Jim Brenner and Dale Wade, 1992 (Journal of Forestry, vol. 90, no. 5, May)

The Forest Fires of April 1963 in New Jersey Can Point the Way to Better Protection and Management – W. G. Banks and S. Little (Proceedings, Society of American Foresters, Boston, Mass. – 1963)

The Foundation for Forestry in New Jersey – C. P. Wilber, State Firewarden of New Jersey, 1922 (American Forestry Magazine

Human vs. Lightning Ignition of Presettlement Surface Fires in Coastal Pine Forests of the Upper Great Lakes – Walter L. Loope and John B. Aberton (American Midland Naturalist, Oct. 1998, vol. 140, no.2)

Ignition Probabilities of Wildland Fuels Based on Simulated Lightning Discharges – Don J. Latham and Joyce A. Schlieter, 1989 (USDA Intermountain Research Station, research paper INT-411)

The Indian as an Ecological Factor in the Northwestern Forest – Gordon M. Day, 1953 (Ecology 14-2)

Indian Fires: the Fire Practices of North American Indians Transformed Large Areas from Forest to Grassland – Stephen J. Pyne, 1983 (Natural History)

Invasive Insects and the Persistence of Oak-Pine Forests in the Mid-Atlantic Region – K. C. Clark, C. Aoki, M. Ayers, J. Kabrick and M. G. Gallagher, 2020 (North Atlantic Fire Science Exchange, Research Brief for Resource Managers – February 2020)

Investigator: Stray Rocket Ignited Pinelands Fire (The Press of Atlantic City, August 3, 1983: Warren Grove, 1,400 acres

The 1963 Lebanon Forest Wildfire and its Effect on Research Station, S. Little and H.A. Somes (Sr.), US Forest Service – Northeastern Forest Experiment Station, New Lisbon (April 30, 1963, # 5100)

Looking Beneath the Surface, the Story of Archaeology in New Jersey – R. Alan Mounier, 2003

New Jersey Ahead of Its Time in Fire Management – Joseph R. Hughes, 1997 (New Jersey Outdoors, spring)

New Jersey Forest Fire Service, Firewardens Emergency Directory – 2019 (NJDEP)

New Jersey Forest Fire Service, Firewardens Emergency Directory – 2021 (NJDEP)

N.J. Air National Guard Considers New Safety Measures (The Press of Atlantic City, November 4, 2004)

The 1963 Lebanon Forest Wildfire and Its Effects on Research Studies – S. Little and H. A. Somes (*Sr.)*, 1963 (US Forest Service – Northeastern Forest Experiment Station, New Lisbon (April 30, 1963, # 5100)

Pilot Safe After Fighter Jet Crashes into Woods Near Parkway (The New York Times, January 11, 2002)

Pine Barrens: Ecosystem and Landscape – Richard Forman, ed., 2012

The Pine Barrens of New Jersey – S. Little, 1979 (Heathlands and Related Shrublands of the World, A. Descriptive Studies

Preliminary Report of the Task Force on Fatal/Near-Miss Fatal Fires – National Coordinating Group, 1980 (memorandum 9210.5-740)

A Preliminary Report on the Forest Conditions of South Jersey – John Gifford, 1895 (Annual Report of the State Geologist for the Year 1894)

Prescribed Burning in New Jersey – NJ Forest Fire Service (n.d. presentation)

Press Release – April 30, 1996 (Ocean County Office of the Prosecutor: Arson Task Force, legislative initiatives)

Railroads and Forest Fires – Horace A. Somes, Jr. and Paul W. Schopp (Sojourn, summer 2019)

Reconstruction of the Spring Hill Wildfire and Exploration of Alternate Management Scenarios Using QUIC-Fire – Michael R. Gallagher, Zachary Cope, Daniel Rosales Giron, Nicholas S. Skowronski, Trevor Raynor, Thomas Gerber, Rodman R. Linn and John Kevin Hines. 2021 (Fire 2021, 4, 72)

The Red Dragon of New Jersey's Forests – anonymous, 1922 (American Forestry, September 1922)

A Report on the Bucto-Harrisville Fires, May 2 – 13, 1930 – J. C. MacDonald, 1930

Report on Forest Fires for Season of 1895 – Gifford Pinchot, 1896 (Annual Report of the State Geologist – 1895)

Rx – Prescribed Burning in the Pine Region of Southern New Jersey and Eastern Shore of Maryland, A Summary of Present Knowledge – S. Little and H. A. Somes *(Sr.)*, US Forest Service, Northeastern Forest Experiment Station (Station Paper 151)

The Scorched Pinelands, Life Springs from the Ashes; Arson May Have Distorted Pinelands Fire Cycle (Atlantic City Press, October 23-25, 1995)

A Study of Forest Fires and Wood Production in Southern New Jersey – Gifford Pinchot, 1899 (Annual Report of the State Geologist for 1898, appendix A)

Sugar Sand Opportunity: Landscape and People of the Pine Barrens – Mark Demitroff, 2014 (Vernacular Architecture Forum_

A 30-Year Fire History of the New Jersey Pine Plains – Kenneth Buckholz and Robert A. Zampella, 1987 (Bulletin – NJ Academy of Sciences, vol. 32, no. 2, fall 1987)

Unused South Jersey – Its Vast Latent Possibilities; What Can Be Done with 1875 Square Miles of Tree-Covered Wilderness, with Magnificent State-Built Roads and Great Railroads Crossing It – Alden T. Cottrell, Assistant Forester – NJ Department of Conservation and Development, n.d.

Valor Awards for Meritorious Action of CCC Men in Tragic N.J. Forest Fire, Three Flame Trapped Men Die, Six Save Selves Thru Swamps – C.C.C., May 30, 1936 (Happy Days, vol. IV, no. 2)

Warbirds Over the Pinelands – Horace A. Somes, Jr. (Sojourn, vol. 5, no. 2, winter 2020-2021)

“Warbirds” Over the Rivers, Historic Observations and Anecdotes, Airspace Over the Wading, Mullica and Bass Rivers during Peacetime and War – Horace A. Somes, Jr. (2019, unpublished)

Warren Grove Flares Caused Forest Fire (Associated Press, July 27, 2007)

Warren Grove Range, New Jersey: Readiness and Environmental Integration (REPI) Program Project Profile (US Air Force, undated)

## ANECDOTAL PINE BARRENS: “BLOOD & FIRE”

Europeans were not the first to bring violence and war to the region. The Lenape, or Delaware, an Algonquin tribe who inhabited the environs of New Jersey and eastern Pennsylvania before the arrival of Europeans, had numerous tales and legends about battles that were both mythical and historical. One of these involved the Yah-qua-whee, a word that has been translated as either “monster” or “mastodon”. According to the Delaware, the Great Spirt placed the Yah-qua-whee on the earth to benefit the natives, but they instead became destructive, making war against both man and the other animals. “It was fierce, powerful, and invincible, its skin so strong and hard that the sharpest spears and arrows could scarcely penetrate it.” A fierce battle ensued, in which the other animals, both great and small, fought the monsters. The hills, mountains and forests became devastated, but in the end, thanks to the ferocity of the animals and the lightning bolts of the Great Spirit, the Yah-qua-whee were defeated. Their own weight drowned them amid the muck and blood of the battlefield, with their great bones occasionally being discovered by the natives years later. The Great Spirit would compensate man by causing cranberries to grow among the marshes and bogs, representing both the muck and blood of the battle and producing life from death.

*David Petriello. 2014. Military History of New Jersey.*

US Army 63rd Division: “BLOOD & FIRE”

WWII Veteran – 2nd Lt. Horace A. Somes, SR.


THANKS
FOR LISTENING.
SMOKEY