Central Pine Barrens Fire Management Plan
April, 1999

Prepared by
Central Pine Barrens Wildfire Task Force
care of
Central Pine Barrens Joint Planning and Policy Commission
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PLAN APPROVALS, REVISIONS AND UPDATES

August 13, 1998 - *A resolution was passed by the Wildfire Task Force members (vote: 20 yes, 2 no), at their meeting held at the Eastport Fire Department, to approve this revised Draft Plan dated July, 1998, with the addition of adding to the list of recommendations for the Central Pine Barrens Commission located in the Executive Summary, a request for financial assistance to purchase water bucket extensions for helicopters to facilitate their access to water sources used for fighting wildfires. This approval was made with the understanding that the Plan would undergo some minor editorial changes, but no substantive changes would be made to its content. It was understood that the Plan would be submitted to the members of the Central Pine Barrens Commission for their acceptance at an upcoming meeting. The Wildfire Task Force, at the same meeting passed a resolution to include the US Fish And Wildlife Service and the NY Army National Guard Aviation Support Facility #1 as members of the Task Force.*

September 16, 1998 - *At the Commission's meeting held on this day at the Suffolk County Park Police Headquarters in Southaven County Park located in Yaphank, the Editorial Board of the Wildfire Task Force presented the Draft Plan to the Commission members with the recommendation that the Draft Plan be adopted by the Commission as an amendment to Chapter 7 of the Central Pine Barrens Comprehensive Land Use Plan, Volume 1. The Commission passed a resolution that authorized staff to commence the State Environmental Quality Review Act (SEQRA) process for the action of the preparation and adoption of the Draft Plan by the Commission. The Commission, at the same meeting, also passed a resolution making the Wildfire Task Force a permanent council of the Commission.*

October 15, 1998 - *A lead agency coordination letter was sent from the Commission to all involved and interested agencies as per SEQR 617.6 along with a completed Long Environmental Assessment Form, Part 1. The preparation and adoption of the Draft Plan by the Commission was determined to be a Type I action under SEQRA. The Commission would assume lead agency if no objection was received from other involved agencies within 30 days of the date of this letter.*

November 18, 1998 -*At the Commission meeting held on this day at Riverhead Town Hall, located in Riverhead, the Commission passed a resolution to assume lead agency status under SEQRA for the action of the preparation and the adoption of the Draft Plan.*

February 23, 1999 - *The Commission members at their meeting held on this day at the Town of Brookhaven, passed a resolution that the preparation and adoption of the Draft Plan would not have significant environmental impact and therefore made a negative determination of significance under SEQRA for this action. Included in this resolution were minor revisions made by the Commission to Chapter 5 of the Plan at Sections 5.1, 5.R and Appendix C, to refine the recommendations for the development of public education programs and a fire danger rating system to promote public safety, especially in regard to the concept of defensible space. The revisions promote consideration and implementation of defensible space strategies based on very specific proposals which will improve the effectiveness of implementation, increase coordination among all involved agencies and which will enhance the protection of areas in need of protection. The Commission determined that these revisions would not have a significant adverse impact on the environment as they were designed in part to ensure mitigation of concerns regarding potential adverse environmental impacts including potential conflicts with the Comprehensive Land Use Plan, local laws and existing covenants and the potential for an adverse increase in clearing of vegetation and disturbance of habitat.*

April 7, 1999 - *A resolution was passed by the Commission members at their meeting held on this day at the Commission's Office located in Great River, to adopt the Plan as amended by the Commission, as the Commission's Central Pine Barrens Fire Management Plan, dated April, 1999.*

CENTRAL PINE BARRENS WILDFIRE TASK FORCE

EXECUTIVE BOARD MEMBERS

CHAIRS: CHIEF PHILIP R. DROWER *(Chief, Wading River Fire Department, and Current Task Force Chair)*

MR. JOHN M. SEARING *(Former Chief, Rocky Point Fire Department, and Original Task Force Chair)*

CO-VICE CHAIRS: CAPT. ROBERT J. CONKLIN *(Chief Forest Ranger, NYS DEC Region 1)*

MR. JOHN M. UREVICH *(Southampton Town Fire Chiefs Council)*

MEMBER AGENCIES, OFFICES AND ORGANIZATIONS

FEDERAL: NY AIR NATIONAL GUARD 106TH RESCUE WING

NY ARMY NATIONAL GUARD AVIATION SUPPORT FACILITY #1

US FISH AND WILDLIFE SERVICE

US FOREST SERVICE

STATE: NYS DEPT OF ENVIRONMENTAL CONSERVATION

NYS OFFICE OF FIRE PREVENTION AND CONTROL

NYS OFFICE OF PARKS, RECREATION AND HISTORIC PRESERVATION

SUFFOLK COUNTY WATER AUTHORITY

COUNTY: SUFFOLK COUNTY DEPARTMENT OF PARKS, RECREATION AND CONSERVATION

SUFFOLK COUNTY FIRE, RESCUE AND EMERGENCY SERVICES DEPARTMENT

TOWN: BROOKHAVEN TOWN FIRE MARSHAL

RIVERHEAD TOWN FIRE MARSHAL

SOUTHAMPTON TOWN FIRE MARSHAL

FIRE DEPARTMENTS AND/OR INDIVIDUAL DISTRICTS:

BROOKHAVEN FIRE DEPARTMENT

BROOKHAVEN NATIONAL LABORATORY FIRE RESCUE GROUP

EAST QUOGUE FIRE DEPARTMENT

EASTPORT FIRE DEPARTMENT

FLANDERS FIRE DEPARTMENT

GORDON HEIGHTS FIRE DEPARTMENT

HAMPTON BAYS FIRE DEPARTMENT

MANORVILLE FIRE DEPARTMENT

MIDDLE ISLAND FIRE DEPARTMENT

MILLER PLACE FIRE DEPARTMENT

QUOGUE FIRE DEPARTMENT

RIDGE FIRE DEPARTMENT

RIVERHEAD FIRE DEPARTMENT

ROCKY POINT FIRE DEPARTMENT

WADING RIVER FIRE DEPARTMENT

WESTHAMPTON BEACH FIRE DEPARTMENT

WESTHAMPTON FIRE DISTRICT

YAPHANK FIRE DEPARTMENT

CHIEFS AND DISTRICTS ASSOCIATIONS:

BROOKHAVEN TOWN FIRE CHIEFS COUNCIL

FIRE CHIEFS COUNCIL OF SUFFOLK COUNTY

RIVERHEAD TOWN FIRE CHIEFS COUNCIL

SOUTHAMPTON TOWN FIRE CHIEFS COUNCIL

SUFFOLK COUNTY FIRE DISTRICTS OFFICERS ASSOCIATION

PRIVATE: THE NATURE CONSERVANCY

STEWARDSHIP COUNCILS OF THE COMMISSION:

LAW ENFORCEMENT COUNCIL

PROTECTED LANDS COUNCIL

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PREFACE

In accordance with New York Environmental Conservation Law (ECL) Article 57-0121(6)(t), part of the Long Island Pine Barrens Protection Act of 1993, the comprehensive land use plan prepared for the Central Pine Barrens was to include provisions for fire management for unanticipated fires ("wildfires") including coordination with local volunteer fire departments. This led to the creation of the Central Pine Barrens Wildfire Task Force in 1995 by the Central Pine Barrens Joint Planning and Policy Commission. This Wildfire Task Force was charged with:

- preparing a Fire Management Plan for the Core Preservation Area and the Compatible Growth Area of the Central Pine Barrens area,
- developing a standard and acceptable Incident Command System (ICS) for response to wildfire incidents consistent with the Suffolk County ICS Plan,
- establishing a fire information program on the activities of the Wildfire Task Force to inform and solicit the support of the Fire Commissioners and Fire Chiefs,
- establishing an appropriate training program for all Suffolk County volunteer firefighters on wildfire-urban interface suppression and
- providing public education on wildfire awareness, safety, and prevention as well as urban interface wild fire prevention and safety.

This Fire Management Plan represents the culmination of work prepared by the members of the Wildfire Task Force to meet its goals set forth by the Central Pine Barrens Commission. The Wildfire Task Force was created following the devastating wildfires that occurred in August of 1995. These wildfires, known as the Rocky Point and Sunrise Fires, burned a total of 6,850 acres of the Central Pine Barrens, located in central Suffolk County. Burned areas included a portion of globally rare dwarf pine plains. These wildfires were unusually severe and large because of extreme drought conditions and high fuel loads.

The members of this Wildfire Task Force include representatives from federal, state, county, local, public and private agencies, departments, and councils with a vested interest in wildfire management within the Central Pine Barrens. As such, this Fire Management Plan is reflective of its Wildfire Task Force membership, mindful of the importance that this Plan also be usable by a broad base of elected officials, volunteers, government personnel and citizens. The Plan therefore includes background information on the ecological importance of the Central Pine Barrens and the relationship which its vegetation has with fire. A glossary of fire terminology is provided in the plan to ensure that this terminology is uniformly defined and to clarify fire terminology that may not be familiar to the general public.

EXECUTIVE SUMMARY

ES.1 BACKGROUND

Over the past several decades, Long Island has seen tremendous growth in the population of residential, commercial, and industrial occupancies in all areas throughout Suffolk County. With increased population comes increased pressure on the land and increased concern with wildfires and their management. The majority of the fires associated with the Central Pine Barrens region result from human action. In order to provide more consistent management of these wildfires and associated tasks, including pre-fire activities, the Central Pine Barrens Wildfire Task Force has developed this Fire Management Plan. This plan was developed keeping in mind that under Article 11 Subsection 176(a) of the Town Law of New York State, it is very clear in the law and undisputed that the chief of the fire department in the fire district where the incident occurs is in charge. The purpose of this plan is to serve as guidance for the fire service community and should not be construed as mandatory for the fire service community to implement.

The purpose of the Wildfire Task Force (WFTF) is to undertake fire planning for wildfire suppression response and to formulate guidelines for the use, where appropriate, of modified wildfire suppression strategies. However, the Wildfire Task Force recognizes that the threat to human lives and property justifies the suppression and control of these wildfires and, further, that aggressive fire suppression must remain an essential cornerstone for response to wildfires in the Central Pine Barrens, given the development and conditions in the surrounding Compatible Growth Area.

The wildfire plan acknowledges and supports the concept that wildfire suppression should remain the standard for areas where wildland and developed areas meet, when fires threaten residential areas, or when human life or property are, presumptively, in immediate danger. This document also acknowledges and supports that for certain relatively "remote" areas in the Central Pine Barrens, modified suppression strategies that use confinement and containment methods with indirect attack, should be considered in the selection of strategy and tactics for this situation. Such modified techniques would enhance firefighter safety by reducing exposure to increased risks associated with direct attack under varying conditions.

ES.2 TASK FORCE CREATION

The Central Pine Barrens Joint Planning and Policy Commission (the Commission) was established in accordance with the Long Island Pine Barrens Protection Act of 1993, as codified in Article 57 of the New York State Environmental Conservation Law. The Central Pine Barrens Commission subsequently prepared and adopted the Central Pine Barrens Comprehensive Land Use Plan which was adopted on June 28, 1995.

In accordance with ECL 57-0121(6)(t) of the Long Island Pine Barrens Protection Act, the plan was to include provisions for fire management for unanticipated fires ("wildfires") including coordination with the local volunteer fire departments. Under this framework, the Central Pine Barrens Commission passed the resolution to establish a "Central Pine Barrens Wildfire Task Force" on November 8, 1995, that was modified on December 6, 1995, January 29, 1997, and March 11, 1998.

The resolution contains six requirements that were ultimately developed into the goals of the Wildfire Task Force. The requirements are:

(1) a fire plan for incident response, mobilization, and resource deployment;
(2) a determination of the wildfire suppression techniques appropriate for use in the Core Preservation Area (CPA) of the Central Pine Barrens (CPB);
(3) a list of criteria and guidelines for the selection and use of each wildfire technique;
(4) fire prevention programs or techniques appropriate for the CPA of the CPB;
(5) a standard system of record keeping for fire incidents in the CPA of the CPB; and
(6) such other components as the Wildfire Task Force shall determine to be essential.

ES.3 MISSION AND GOALS

From these six requirements, the Wildfire Task Force developed a mission statement and goals. The mission of the Central Pine Barrens Wildfire Task Force is to undertake fire planning for wildfire suppression that ensures the safety of emergency response personnel and the public, while considering the ecological concerns of the Core Preservation Area of the Central Pine Barrens region. From this mission, the goals of the Wildfire Task Force are:

Goal 1: Develop a Fire Management Plan for the Core Preservation Area of the Long Island Central Pine Barrens region.

Goal 2: Develop a standard and acceptable Incident Command System (ICS) for response to wildfire incidents consistent with the Suffolk County ICS Plan.

Goal 3: Establish a fire information program on the activities of the Wildfire Task Force to inform and solicit the support of the Fire Commissioners and Fire Chiefs for the work of this Wildfire Task Force.

Goal 4: Establish an appropriate training program for all Suffolk County volunteer firefighters on wildfire-urban interface suppression.

Goal 5: To provide public education on wildfire awareness, safety, and prevention, as well as urban interface wildfire prevention and safety.

This Fire Management Plan represents the detailed work of the Wildfire Task Force with respect to its goals.

The Plan provides information on:

- The Long Island Pine Barrens (Chapter 2)
- The fire environment (Chapter 3)
- Wildfire prevention (Chapter 4)
- Pre-suppression management (Chapter 5)
- Fire suppression (Chapter 6)
- Communication (Chapter 7)
- Post fire activities (Chapter 8)
- Fire management and responsibilities (Chapter 9)
- Training (Chapter 10), and
- A prescribed fire program (Chapter 11)

A glossary is provided in Appendix A to clarify and explain fire related terms used in this document that may be unfamiliar to the general public.

This plan is intended to be a "living" document that will evolve with time and experience. Future development and changes to this plan will depend on continued interaction of all the groups involved thus far and in the continued efforts of the Wildfire Task Force. The Task Force has developed the following list of recommendations to submit to the Central Pine Barrens Commission. Identified after each recommendation, where applicable, is the chapter of the plan that provides the basis for this recommendation. The implementation of the following recommendations will enable the functional pieces of this plan to come to fruition. More general recommendations applicable to the fire service community are provided at the end of Chapters 3 through 11 (excluding Chapter 9).

ES.R RECOMMENDATIONS TO THE PINE BARRENS COMMISSION

- Since the Wildfire Task Force has brought multiple agencies and jurisdictions together to discuss openly and freely a mutual concern, ***it is recommended that the Wildfire Task Force be made a permanent Committee of the Central Pine Barrens Commission.*** (Executive Summary)

- ***Continue making the existing fire weather data and drought index information available*** to local Fire Chiefs and their departments, and develop a local capability for weather data capture to enhance the value and interpretation of this weather information for our local needs. (Chapter 3: Fire Environment)

- ***Establish a daily Fire Danger Rating System and a public information notification system.*** (Fire Index System) (Chapter 4: Wildfire Prevention)

- ***Encourage each municipality to assess the codes and recommended guidelines for housing and development in the wooded wildland-urban interface communities with an eye for defensible space, and develop educational programs*** to inform the public and contractors about the guidelines. (Chapter 4: Wildfire Prevention)

- ***Develop or obtain wildfire prevention programs which can be adapted by local fire departments*** to be used in conjunction with their existing fire prevention programs. Such programs should present the positive and negative aspects of fire in the Central Pine Barrens. (Chapter 4: Wildfire Prevention)

- ***Establish a reporting system as well as a reward program for reporting and conviction of anyone involved in setting an unauthorized fire in open lands.*** The present Neighborhood Watch or a similar program could be expanded. (Chapter 4: Wildfire Prevention)

- ***By the fall of 1999, initiate the preparation of a Fire Protection Assessment to determine the needs, targets and recommendations for wildland fire suppression in conjunction with fire departments.*** This assessment will be for the entire Central Pine Barrens first and then, if individual fire departments are interested in such a plan, a more detailed assessment will be prepared for their areas. (Chapter 5: Pre-suppression Management)

- ***Establish, in writing, the protocol for requesting the use of a helicopter for aerial suppression support through the State Emergency Management Office, the NYS DEC, the NY Air Guard, or the NY Army Guard units.*** (Chapter 6: Fire Suppression)

- ***Approach the Central Pine Barrens Commission to provide funding to purchase three, fifty foot water bucket extensions to increase the accessibility of helicopters with water buckets to water areas for aerial suppression activities.***

- ***Educate and train fire departments on the use of the developed forms for fire size-up and the wildfire checklist.*** (Chapter 6: Fire Suppression)

- ***Establish, with the Suffolk County Police Department, an 800 MHz talk group to be utilized during times of major wildfires, as well as assigning a talk group for the routine operations of Suffolk County Fire Rescue and Emergency Services (SC FRES).*** This may include one or more disaster talk groups to be activated only during major incidents. This will include the development of a procedure, by which the FRES Commissioner will authorize various Fire, Emergency Medical Services (EMS) or other entities to access the talk group(s) and when the disaster talk group(s) will be activated. (Chapter 7: Communication)

- ***Approach the Central Pine Barrens Commission to provide funding to purchase 25 portable radios for use on the Suffolk County Police Department 800 MHz system,*** which will be stored in a suitable, centrally located facility, for ready dispersal when needed. (Chapter 7: Communication)

- ***Develop a Communications Discipline & Protocol Training plan to be adopted by fire departments and auxiliary agencies.*** This is essential because it is absolutely vital that adequate training in proper radio use and discipline be implemented. Keeping messages clear and concise, and transmitting only pertinent information is paramount. Consideration should be given to the use of plain language in major emergencies. (Chapter 7: Communication)

- ***Approach the Central Pine Barrens Commission to provide funding to purchase 75 Global Positioning System (G.P.S.) units to provide locations for emergency vehicles during emergencies.*** (Chapter 7: Communication)

- ***Pursue arrangements with cellular wireless service providers, in the event of a major emergency during which the normal cellular telephone network may become overwhelmed and of limited value, that, upon the request of the SC FRES Commissioner, additional resources will be supplied, as needed.*** (Chapter 7: Communication)

- ***Using the abilities of the Wildfire Task Force, its members, and in cooperation with the fire service and the SC FRES Combined Radio Committee, investigate the available options for overall improvement in communications and communications systems.*** The review should include assessment of the availability of an appropriate block of channels in one spectrum for fire service use, how to obtain supplemental funding to assist the fire service to changeover to any new system, and appropriate education and guidelines for radio use and discipline in emergency situations. (Chapter 7: Communication)

- ***With funding from the Central Pine Barrens Commission, establish a fully automated and computer accessible weather station on Suffolk County's North Shore.*** (Chapter 8: Post Fire Activities)

- ***Each and every fire department located in the Central Pine Barrens should report, using a standardized form, all wildfires to the NYS DEC Forest Rangers,*** so that the information can be logged into a central database for reporting back to the Wildfire Task Force and for other uses. (Chapter 8: Post Fire Activities)

- ***It is imperative that all fire suppression personnel know and understand the Incident Command System (ICS) and where they fit in.*** Continue training in ICS. (Chapter 10: Training)

- ***A prescribed fire management plan for the Central Pine Barrens, describing the pros and cons of using prescribed fires for ecological, educational and fuel reduction purposes should be developed*** by the summer of 1999. (Chapter 11: Prescribed Fire Program)

- ***Discuss options, pros and cons of making all or part of the Central Pine Barrens a NYS DEC fire district*** to enable better use of NYS DEC and recovery of funds for any wildfire. Develop a plan by Fall of 1999.

- ***Investigate the background of, and develop a proposal to the Central Pine Barrens Commission (or other appropriate agency) for funding payments in lieu of taxes (PILOT) for fire districts with preserved public land*** in the Central Pine Barrens area.

CHAPTER 1: INTRODUCTION

Wildfires once burned freely, occasionally for days or weeks, over thousands of acres extending from the Hempstead Plains in Nassau County to the Central Pine Barrens of Southampton. Such extensive conflagrations no longer occur, partly because the Central Pine Barrens are less than the original estimated 250,000 acres, with the remaining acres now crisscrossed by numerous roads and clearings that serve as effective firebreaks, and partly due to heightened suppression and prevention activities. Most of these fires are single day events kept to a minimal size due to early detection and aggressive suppression. However, even small fires can pose an acute hazard in and adjacent to the Central Pine Barrens. The threat to human lives and property justifies the suppression and control of these wildfires. Unplanned ignitions and resulting wildfires are not a substitute for the ecological process that fire plays in this ecosystem and are unacceptable from a public safety, ecological, and management standpoint. The expenses and risks to firefighting personnel are also unacceptable. Aggressive fire suppression must remain an essential cornerstone of the pine barrens fires under these conditions.

Wildfires can be suppressed using a variety of strategies including confinement, containment, and control. These strategies utilize the tactics of both direct and indirect attack. Control strategies with direct attack tactics and heavy reliance upon mechanized equipment are the current means used by most fire departments in suppressing wildfires in the Central Pine Barrens. Most departments within the Central Pine Barrens use the Incident Command System (ICS) with heavy dependence upon mutual aid assistance. The mutual aid response is coordinated through the Suffolk County Fire, Rescue and Emergency Services (SC FRES) Department. This plan realizes the success that this well established structure has for suppressing wildfire within the Central Pine Barrens.

There has been an ecological cost to the way in which wildfires have been suppressed by the direct attack method. Although almost every area of the Central Pine Barrens is crisscrossed with firebreaks and old woods roads, these are not always used during new fires. Subsequently, new firelines may be created which may cause long term problems, including the introduction of new roads. Recovery of vegetation within these firebreaks is subsequently prevented due to the new firebreaks becoming unofficial roads for vehicle use by trespassers. These temporary firebreaks may persist for many years, and may become access points for dumping or the source of new interior roads. Currently, no one has responsibility to carry out rehabilitation of these new inroads. Further, there are limited resources to patrol these roads or to restore them.

Modified suppression strategies that use confinement and containment methods with indirect attack should be considered. This is especially true where there are already existing fire or woods roads. Full suppression should remain the standard for areas where wildland and developed areas meet and human life and property are in immediate danger. However, many areas of the Central Pine Barrens are relatively remote, and wildfire suppression could take place

using alternative methods based on fire location, weather conditions, resource availability, and safety considerations.

While there may be an increase in personnel time when using modified suppression strategies, this can be offset by the reduction in equipment expenditures, especially those outlays caused by equipment damage. The modified suppression tactics with minimum impact strategies will also reduce the firefighters' exposure to risk simultaneously reducing the damage to the land resource. While this may lengthen the duration of the wildfire event and may increase overall acreage involved, the total number of personnel required at any one time is reduced.

An Escaped Fire Situation Analysis (EFSA) completed for each extended attack fire should be considered to evaluate the feasibility of the appropriate suppression response. The EFSA should be completed in consultation with the landowner. Landowning agencies may assign a resource advisor for any fire to work within the Incident Command System and directly with the Incident Commander (IC) in developing suppression strategies and tactics. Pre-fire planning will be an important part of directing the appropriate suppression response due to the short duration of most fire events in the Central Pine Barrens. Since Long Island does not have a state fire district, state funds are not available to local fire departments for wildfire suppression activities. Additional issues that need to be addressed include prevention programs and establishment of a standard system of record keeping for fire events.

Total fire suppression would result in continued, unchecked fuel build-up, which increases the risk of catastrophic fires outside the natural variability of this fire regime. Experience elsewhere in the country has shown there is a point of negative return from total suppression. At that point, even heavy staffing is unable to suppress one hundred percent of the fires. Eventually, events and conditions (i.e., heavy fuel loadings, multiple ignitions, weather events with low relative humidity, strong winds, and high temperatures) overburden suppression capabilities, resulting in conflagrations or multiple fires beyond the control of resources. A solution for this lies in the development of a prescribed burning program. A detailed discussion of a prescribed fire program is presented in Chapter 11.

This Fire Management Plan provides a comprehensive evaluation of the issues associated with wildfires in the Central Pine Barrens. Each chapter of this document details various components associated with the overall successful management of fire in the Central Pine Barrens from prevention, suppression, and ecological standpoints.

CHAPTER 2: DESCRIPTION OF THE LONG ISLAND PINE BARRENS

2.1 BACKGROUND

The passage of the Long Island Pine Barrens Protection Act of 1993 lead to the delineation of the Central Pine Barrens. The Long Island Pine Barrens is recognized as one of the natural treasures of the northeast and represents a globally unique ecosystem that is formed on extensive glacial deposits along the coast. The Central Pine Barrens is home to thousands of plant and animal species, some of them endangered or threatened with extinction or extirpation. The majority of the Central Pine Barrens overlies an area where deep aquifer recharge occurs. Groundwater in this area is considered of relatively pure quality, warranting special protection as an important drinking water resource.

The information in this chapter was obtained from Volume 2 of the Central Pine Barrens Comprehensive Land Use Plan (Central Pine Barrens Joint Planning and Policy Commission, 1995). Copies of the Plan are available through the Central Pine Barrens Commission[1]. This chapter presents a synopsis of ownership and development patterns along with existing environmental conditions (climate, topography and ecosystems) in the Central Pine Barrens. This information provides an understanding of the natural systems in the Central Pine Barrens that can affect firefighting capabilities such as topography and slopes and the unique ecosystems that have an interrelationship with fire. The information on ownership and development patterns illustrates the increase in the wildland-urban interface that has occurred within the Central Pine Barrens that affects firefighting resources.

2.2 LOCATION

The Long Island Pine Barrens estimated to have originally covered 250,000 acres on Long Island, has been reduced to approximately 100,000 acres[2]. Article 57 of the New York State Environmental Conservation Law created a Core Preservation Area of approximately 50,000 acres that is largely undeveloped and a comparable sized Compatible Growth Area that generally surrounds the Core Preservation Area. The largest portion of the Central Pine Barrens area lies within the Town of Brookhaven with the rest extending into the Towns of Riverhead and Southampton. Smaller areas are also located within the northern portion of the Villages of

[1] The Central Pine Barrens Commission office is located at 3525 Sunrise Hwy., 2nd Floor, in Great River. Copies of the Plan may be obtained there, examined at the onsite library there, or viewed at numerous libraries located in and around the Central Pine Barrens.

[2] As of July 12, 1998, the total acreage of the Central Pine Barrens area was increased to approximately 102,500 acres due to the signing into law a legislative bill (Assembly Bill 11132 and Senate Bill 7611) that altered the New York Environmental Conservation Law Article 57 (the state pine barrens legislation) to include the federally owned and managed Wertheim National Wildlife Refuge into the Central Pine Barrens. This increased the size of the Core Preservation Area to approximately 55,000 acres.

Quoque and Westhampton Beach. Figure 2-1 depicts the Core Preservation Area and Compatible Growth Area boundaries, overlaid with corresponding fire district boundaries.

2.3 OWNERSHIP AND DEVELOPMENT PATTERNS

Information on ownership and development patterns within the Central Pine Barrens is obtained by examining demographic and land use information for this area.

2.3.1 Demographic Information

Demographic information in this section includes information on population, population density and housing. Estimates of population and housing units were based on estimated percentage allocations of population by census tract within the Compatible Growth Area and Core Preservation Area of the Central Pine Barrens.

Population Estimates

The 1990 population of the Central Pine Barrens area was estimated to be 57,207. The total population of the Central Pine Barrens represents four percent of Suffolk County's population while occupying 17 percent of the County's land area. The number of residents in the Central Pine Barrens has increased dramatically over the past thirty years, from 12,525 in 1960 to 57,207 as of 1990. Eighty seven percent of the population in the Central Pine Barrens area is located in the Town of Brookhaven with 11 percent located in the Town of Southampton and two percent in the Town of Riverhead. Ninety-three percent of the Central Pine Barrens 1990 population total reside in the Compatible Growth Area with seven percent in the Core Preservation Area.

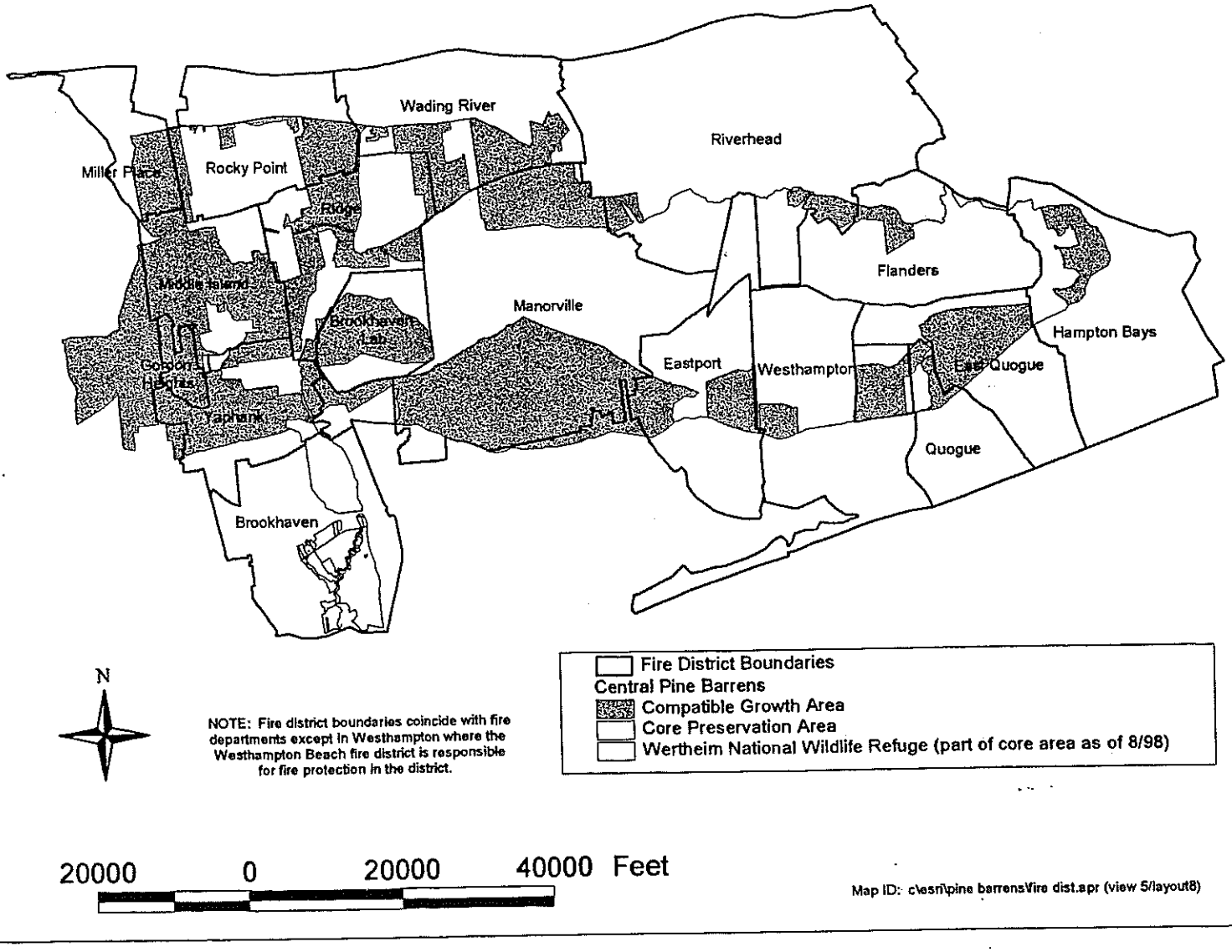
This growth in population and resultant increase in the suburban wildland interface zone has affected the fire service community and firefighting resources available. Many fires now occur in interface areas where the potential for personal injury and structural damage are increased.

Housing

In 1990, there were 23,180 houses in the Central Pine Barrens. Over 90 percent of the homes were located in the Compatible Growth Area. The balance were located in the Core Preservation Area. As expected, most of the housing units in the Central Pine Barrens are concentrated in the Compatible Growth Area in the Town of Brookhaven.

An estimated 885 housing units (approximately four percent) are seasonal. Nearly one quarter of those seasonal homes are estimated to be in the Core Preservation Area. The presence of seasonal housing adds to the population estimate for the Central Pine Barrens during peak

FIGURE 2.1
CENTRAL PINE BARRENS WILDFIRE TASK FORCE FIRE DISTRICTS



seasonal times (usually the summer season). At an estimated four persons per household in seasonal homes, the population in the Central Pine Barrens can be expected to rise by about 3,500 (about six percent) at peak seasonal times. Guests in year-round housing units, motels, and campsites also add to the seasonal population.

2.3.2 Land Use

Information concerning land use provides basic data on land characteristics and the various activities that occupy land in the Central Pine Barrens area.

The major land uses in the Central Pine Barrens are vacant land, comprising 35,260 acres (38 percent) and recreation and open space comprising 25,031 acres (27 percent). Less significant uses include residential (11,599 acres or 12 percent), institutional (10,410 acres or 11 percent) and agricultural uses (4,601 acres, or 5 percent). Approximately half of the acreage in institutional use is located within Brookhaven National Laboratory's boundaries.

The remaining six land use categories are less significant in terms of acreage. These categories are transportation, commercial, utilities, industrial, surface waters, and waste handling and management, which account for less than seven percent of the land use in the Central Pine Barrens.

2.4 CLIMATE

The climate in Suffolk County is mild due to its coastal location. Climatic conditions vary throughout Suffolk County with changes in topography and distance from the coasts. Temperature extremes in the summer are modified by the cooling ocean breezes that form off the south shore of Long Island (Suffolk County Planning Department, 1984). The average temperature in Suffolk County is 71.9°F in the summer and 32.4°F in the winter (LI Business News, 1997). Relative humidity is a rough index of the moisture capacity of the air that varies with the season. The average annual relative humidity is 70 percent (LI Business News, 1997). The prevailing wind directions in Suffolk County are northwest and southerly that reflect the dominance of cold arctic air masses in the winter and cooling ocean breezes in the summer (Suffolk County Planning Department, 1984). The average annual wind velocity in Suffolk is 9 miles per hour (LI Business News, 1997).

2.5 TOPOGRAPHY

The elevations within the Central Pine Barrens area range from mean sea level where the area borders Flanders Bay in the Town of Southampton, to a high of 295 feet at Bald Hill, which is on the Ronkonkoma Moraine just northwest of the Eastern Campus of Suffolk County Community College (SCCC), in the Town of Southhampton, south of the Town of Riverhead

business district. Generally, elevations are lowest in the areas where recent geologic deposits are found and highest in the moraine areas.

Slopes within the area of the Central Pine Barrens where outwash plains and recent deposits can be found are generally even to gently rolling, and range from 0 to 15 percent. The moraine areas are very hilly and uneven containing slopes that range from 15 to 35 percent in many areas.

2.6 ECOSYSTEMS

The Long Island Central Pine Barrens region is a complex mosaic of pitch pine woodlands, pine-oak forests, coastal plain ponds, swamps, marshes, bogs and streams. Characteristic of the Central Pine Barrens natural communities is their evolution in the presence of frequent fires.

The dominant tree species in the frequently burned areas is the pitch pine (*Pinus rigida*), which is highly fire adapted and somewhat fire resistant. Pitch pine woodlands are characterized by widely spaced pitch pine. This spacing allows abundant sunlight to penetrate the open tree canopy allowing dense growth of the shrubby scrub oak (*Quercus ilicifolia*), and smaller heath species such as black huckleberry (*Gaylussacia baccata*), blueberry (*Vaccinium pallidum and V. angustifolium*), sheep laurel (*Kalmia latifolia*) and wintergreen (*Gaultheria procumbens*).

In less frequently burned areas various species of tree oaks codominate, and the tree canopy is more closed. Under these more shaded conditions, scrub oak and heath shrubs decline in importance (Reiners 1965, 1967). The herbaceous layer tends to be fairly sparse but is more developed in sunlit conditions. Characteristic species of the herbaceous layer include bracken fern (*Pteridium aquilinum*), and Pennsylvania sedge (*Carex pensylvanica*). Located in freshwater wetlands are red maple (*Acer rubrum*), tupelo (*Nyssa sylvatica*) and Atlantic white cedar (*Chamaecyparis thyoides*).

CHAPTER 3: FIRE ENVIRONMENT

3.1 INTRODUCTION

This chapter presents an overview of previous fire activity on Long Island that is extremely useful in understanding current fire trends and suppression requirements. It includes a discussion on how forest fuels (vegetation) and weather conditions influence fire behavior.

3.2 FIRE HISTORY

The importance of fire prior to European settlement is indicated by the presence of fossil pitch pine pollen and abundant charcoal in the sediments of Deep Pond, in the Boy Scout camp at the northern edge of the Central Pine Barrens. It is difficult to determine the exact number of fires, but distinct layers of charcoal in the sediment core indicate that there were at least eight major fires in the past 2200 years. There may have been more numerous lighter or smaller fires that cannot be distinguished individually (Backman 1984). These fires could have been set by lightning and by Native Americans (Central Pine Barrens Joint Planning and Policy Commission, 1995). Reports of fire are common from the time of the very earliest explorers (Morton 1632, Wood 1634).

Large fires became more common after European settlement. Severe and extensive wildfires burned through the Central Pine Barrens repeatedly during the 1800's, with especially large fires in 1839, 1845, 1848, and 1862, 1930's, 1960's, and 1995 (see Appendix B of this document). Many of the early fires may have been caused by sparks from the wood burning engines of the Long Island Railroad; however, arson was a frequent source of the fires (Central Pine Barrens Joint Planning and Policy Commission, 1995).

Fire occurrences since 1930 have been investigated by Windisch (1994), using historic aerial photography, fire department records, newspaper articles, and verbal accounts. Over 130 fires within or near the Long Island Central Pine Barrens (Core Preservation Area and Compatible Growth Areas) were documented and approximately located. About 145 or more additional fires were documented from fire records or other sources, but could not be mapped without better written documentation, or additional aerial photography (Windisch 1994). With the advent of aggressive fire suppression, fires, although still frequent, tend to be smaller than in the past because they are quickly controlled. Several of the largest fires since 1930 are included in the table provided in Appendix B.1.

Two unusually large, severe wildfires, known as the Rocky Point and Sunrise Fires, burned a total of 6,850 acres of the Central Pine Barrens in late August and early September in 1995. Burned areas included a portion of the globally rare dwarf pine plains. The wildfires were unusually severe and large because of extreme drought combined with high fuel loads

accumulated in the 65 years since the last major fire. A more detailed analysis and history of wildfires should be developed by the Wildfire Task Force and kept current.

3.3 FOREST FUELS

Fire behavior is governed to large extent by the vegetation involved in the fire. The species composition, structure and amount of fuel determine the fire behavior, the intensity of the fire, its rate of spread and the flame lengths. In the context of fire behavior, the vegetation can be described in terms of fuel models, mathematical models that estimate fire behavior based on vegetation type. Fuels have been classified into 13 different fuel models. The following references to fuel models refer to Rothermel's fuel models developed in 1972 and published in "Aids to Determining Fuel Models for Estimating Fire Behavior" (Hal E. Anderson, 1982). Of the thirteen fuel models, the models described in the following subsection are those applicable to the Long Island Pine Barrens. An excerpt from "Aids to Determining Fuel Models for Estimating Fire Behavior" that explains how fuel models are developed is provided in Appendix B.2 along with a further description of the fuel models applicable to the Central Pine Barrens.

3.3.1 Grasslands

Grassland communities comprise approximately 6 percent of the Core Preservation Area and 5 percent of the Compatible Growth Area. Fuel models 1, 2, and 3 represent these grasslands (depending on height of grass and amount of trees and shrubs). Scattered shrubs may be present. Fire ignition and spread are governed by the fine herbaceous grasses that have cured or nearly cured. These fires are surface fires that move rapidly.

Typical types of vegetation represented by these fuel models include old fields dominated by little bluestem, sometimes with scattered shrubs and trees, and dry coastal plain ponds with herbaceous cover.

3.3.2 Hardwood Forest

Hardwood forests comprise less than one percent in both the Core Preservation Area, and the Compatible Growth Area. Fuel models 8 and 9 represent this forest depending on the amount of dead fuel. These stands consist of mixed hardwoods with scattered pines with little understory of shrubs. The primary surface fuel is loose leaf litter and occasional twigs. The fires are generally slow burning surface fires with low flame lengths, although the fire may encounter a heavy fuel concentration causing a flare-up. High winds can increase the rate of spread of a fire from blowing burning leaves, especially oak leaves.

The dense shrub layer present in the pine-oak forest is absent. Typical examples are closed canopy oak-hickory forest, beech forest and black locust stands found on moister, richer soils. Scattered pitch pines may be present.

3.3.3 Pine-Oak Forest

The majority of the vegetation of the Central Pine Barrens (70 percent of the Core Preservation Area) consists of pine oak forest with a dense understory of flammable scrub oak, blueberry, and huckleberry. These forests are represented by fuel model 6, although this model tends to underestimate fire behavior. Areas in the Central Pine Barrens with an open canopy and an understory of scrub oak are classified as fuel model 4. Within the forests, the dense and continuous shrub layer provides an abundance of fuel throughout the year.

Leaf litter provides a flash fuel and the dead twigs and branches present in the shrub layer ignite easily. Except during spring, leaves of most shrub species will readily burn. The leaves and stems of the shrubs sustain fire and carry heat and flames upward to the canopy. In most stands the dense shrub layer provides a continuous horizontal and vertical source of available fuel. Flame lengths three times the height of the shrub layer are common under wildfire conditions. Crowning and spotting is a danger when pitch pines are present.

Volatile resins in the leaves generate intense fires during the growing season. High accumulations of standing dead shrubs aggravate this situation. Rate of spread, flame length and fireline intensity, under wildfire conditions, often approach or exceed the levels at which hand crews can safely and effectively work.

3.3.4 Dwarf Pine-Scrub Oak Shrubland

Shrubland vegetation dominated by scrub oak and/or dwarf pitch pine comprises approximately 10 percent of the Core Preservation Area, and less than one percent of the Compatible Growth Area. Fuel model 4 represents the shrublands with very little canopy cover. The intertwined scrub oak, dwarf pines, huckleberry, blueberry and bearberry form dense continuous fuel cover that is about six to fifteen feet in depth. Foliage, live and dead twigs and branches carry the fire. Fires are of high intensity and spread rapidly with high potential of spotting. Volatile resins in the needles and leaves generate intense fires during the growing season. High accumulation of standing dead shrubs contributes to intensifying the fire.

The dwarf pine plains in Westhampton is the only example of the combination of scrub oak and pitch pine. Associated with the dwarf pine plains and elsewhere in the Central Pine Barrens are large areas dominated by scrub oak with scattered tall pitch pine.

3.4 ANNUAL FIRE WEATHER

3.4.1 Weather Influence

Wildfire behavior is greatly influenced by local weather conditions. Weather conditions

include: relative humidity which affects moisture content of the air and fuels; wind which affects the direction and speed of fire spread; and air temperature which affects the ambient temperature of the fire fuels.

Fire conditions worsen as temperature increases and relative humidity decreases. Wind speeds in excess of 10 mph also begin to increase fire intensity, the rate of fire spread and growth by adverse fire behavior and spotting. Fires become most difficult to control when relative humidity falls below 30 percent.

Data on fire weather is an important tool for both the prevention and suppression tactics of wildfires. This data is available to the local fire departments through Suffolk County Fire Rescue Communications. It is currently calculated by the US Fish and Wildlife Service at the Wertheim Preserve located in the Brookhaven Fire District.

This data consists of a continuous record of pertinent weather conditions and the calculation of the fuel moisture content of 1 hour fuels, 10 hour fuels and 100 hour fuels. The daily readings are analyzed by a special computer program that includes the daily drought index, 10 hour fuel moisture, and wind speed. The longer the area goes without rain, has low relative humidity, high temperatures and low fuel moisture, then the higher the drought index number, and subsequently, the fire weather index.

Table 3.1: Drought Index and Fire Intensity *(Index values range from 0 to 800)*	
0 to 200	Wet condition, low fire intensity
200 to 350	Dry condition, moderate fire intensity
350 to 450	Very dry condition, high fire intensity
Greater than 450 to 800	Drought condition, extreme fire intensity

Table 3.2: Ten Hour Fuel Moisture and Fire Intensity	
Greater than 15%	Moist fuel, low fire intensity
7% to 15%	Dry fuel, moderate fire intensity
Less than 7%	Very dry fuel, high fire intensity, and high possibility of crown fires

Table 3.3: Wind Speed and Fire Characteristics	
0 to 5 miles per hour	Low flame heights (< 6 feet), slow fire spread
5 to 10 mph	Moderate flame heights (6 to 10 feet), moderate fire spread
Greater than 10 mph	High flame heights (> 10 feet), fast fire spread, crowning and spotting potential

As this new tool is used, the fire service can develop the local relationship of the fire weather index number to actual fire activity (number of fires, size and severity). Once this relationship is known for Suffolk County, the fire weather index can serve as both a guide for preventive action (limiting public access to park areas, canceling burning permits, public information bulletins, etc.) and a "size-up" tool for Incident Commanders (ICs) on actual wildfires.

3.4.2 Long Island Weather Cycle

Long Island has unique wind patterns due to the large bodies of water surrounding the island (Long Island Sound to the north and the Great South Bay and Atlantic Ocean to the south). Wind breezes are typically sea breezes during the morning through midafternoon and switch to land breezes in late afternoon. This switch can bring about as much as a 180 degree change in wind direction and also a change in wind speed. The unpredictability and uncertainty of local wind directions as well as speeds makes deployment of suppression and standby resources more difficult for the IC. These wind conditions also make the use of "line firing" techniques questionable (and generally not advisable), especially if there are no highly trained and experienced personnel available.

Long Island typically experiences two distinct brush fire seasons. The spring season, late March thru April, typically sees both surface and crown fires. The fall season, late September thru mid-October, typically sees a large number of surface fires of 10 acres or less. Crown fires during the fall season occur more often due to dry or dead leaves still on the trees. The fall season may also include more ground fires making mopup and control more difficult and time consuming.

In recent years, however, unusually dry weather conditions have caused large fires outside the normal wildfire season. In August of 1995, Long Island had its two largest wildfires in recent history (the Sunrise and Rocky Point Fires) and the preceding dry winter (1994-95) also

produced large wildfires (i.e., those requiring mutual aid). During the time of the Sunrise and Rocky Point Fires, the local drought index exceeded 500, indicating extremely dry conditions conducive to fire.

Based on Long Island's unique weather patterns and unpredictable fire seasons, the best tool for forecasting wildfire activity is the local fire weather data and drought index. The Wildfire Task Force hopes to continue the availability of this weather data and drought index to local fire chiefs and to develop local data to enhance the value and interpretation of this data for local needs.

3.5 WILDLAND-URBAN INTERFACE

Population increases and the migration of citizens from urban centers to wildlands have complicated the fire protection mission of the local volunteer fire departments in Suffolk County. Years of settlement into the wildlands of Suffolk County and aggressive fire suppression activities have led to increasing fuel levels, increasing the amount of dead fuel per acre. This increases fuel ladders that allow fires to reach conflagration sizes quicker and more frequently. Suffolk County firefighting forces have experienced a change in the type and size of these wildland fires over the past few years. Although wildland fires are not necessarily getting larger, they are burning at a higher level of intensity due to the increasing fuel levels, creating a greater risk to structures, public buildings and natural resources in the interface zone.

A review of other wildland-urban interface fires in the United States indicates there are many common denominators that contribute to major losses of homes and property, loss of lives, injuries, destruction of natural resources, and adverse effects on wildlife habitats and water resources.

The common denominators of these fires include:

- Poor access for emergency and evacuation vehicles
- Hot, windy, dry conditions
- Sloping topography
- A build-up of wildland vegetation
- Lack of defensible space
- Use of combustible construction materials
- Lack of public education and information
- Poorly equipped and trained wildfire suppression forces

Although the above listing is from critiques nationwide, Suffolk County does have some of the conditions listed that could increase the likelihood of a large wildfire conflagration, such as the Rocky Point and Sunrise Fires, to reoccur. This plan, in later sections, includes information on how to address the items listed above. This information will assist in decreasing the intensity of future wildfires and the risk to structures and the public within the wildland-urban interface zone.

3.R RECOMMENDATIONS

- Continue making the existing fire weather data and drought index information available to local Fire Chiefs and their departments, and develop a local capability for weather data capture to enhance the value and interpretation of this weather information for our local needs.

CHAPTER 4: WILDFIRE PREVENTION

4.1 FIRE PREVENTION

Fire prevention, which includes all activities concerned with minimizing the incidence of destructive fires, is accomplished through education, regulating the public use of the Central Pine Barrens during periods of high fire danger, and establishing and enforcing rules and regulations regarding building in wildland-urban interface areas.

4.2 PUBLIC NOTIFICATION OF FIRE DANGER

A goal of the Wildfire Task Force is to establish a fire danger ranking and public notification system (see fire weather index system discussion in Section 3.4.1) for the Central Pine Barrens. A warning system for the public (radio and newspaper public service announcements) could be developed based on the fire index system to notify the public of periods of high fire danger.

The fire danger guidelines should be developed for State, County and town officials, as well as other groups that use the open lands within the Central Pine Barrens. The purpose of these guidelines is to aid in decision making with respect to open fires and access to lands during times of high fire danger.

4.3 SAFETY RECOMMENDATIONS AND GUIDELINES FOR THE WILDLAND-URBAN INTERFACE

The Central Pine Barrens contain high value homes and commercial properties intermingled with highly flammable native vegetation. Such a development pattern greatly complicates the duties of firefighters and increases the risk to properties and lives. Defensible space (open, nonflammable area around structures), access and construction materials are three factors that can be managed to reduce the threat of wildfire damage and improve the firefighters' ability to defend structures within the Central Pine Barrens.

A goal of the Wildfire Task Force is to provide safety recommendations regarding existing and future development within the wildland-urban interface. Each municipality (e.g., building department, fire marshal and volunteer fire department) should assess the codes and recommended guidelines for housing and development in wooded wildland-urban interface communities. Educational programs should be developed to inform the public and contractors about the guidelines.

4.4 PUBLIC INFORMATION AND EDUCATION

Although lightning strikes do ignite wildfires, fires caused by people account for the majority of wildfires in the Central Pine Barrens. Accidental fires, which are a minority, are most commonly caused by discarded cigarettes, vehicles, machinery use and open burning.

The Wildfire Task Force has a goal to develop fire prevention, fire safety and public information programs regarding fire in the Central Pine Barrens. Programs on wildfire prevention, either obtained or developed, should be adapted by local fire departments for use with their existing fire prevention programs. Such a program should present the positive and negative aspects of fire in the Central Pine Barrens. A reporting system should be established as well as a reward program for the reporting and conviction of anyone involved in setting unauthorized fires on open lands.

Since the Wildfire Task Force recognizes the predominance of the wildland-urban interface, a goal is to inform the homeowner and residents on fire safety, survival of wildland fires and development of their own defensible spaces. These programs will be developed at a future time by the Wildfire Task Force.

4.R RECOMMENDATIONS

- Establish a daily Fire Danger Rating System and a public information notification system. (Fire Index System)

- Encourage each municipality to assess the codes and recommended guidelines for housing and development in the wooded wildland-urban interface communities with an eye for defensible space, and develop educational programs to inform the public and contractors about the guidelines.

- Develop or obtain wildfire prevention programs which can be adapted by local fire departments for use in conjunction with their existing fire prevention programs. Such programs should present the positive and negative aspects of fire in the Central Pine Barrens.

- Establish a reporting system as well as a reward program for reporting and conviction of anyone involved in setting an unauthorized fire in open lands. The present Neighborhood Watch or a similar program could be expanded.

CHAPTER 5: PRE-SUPPRESSION MANAGEMENT

5.1 PRE-PLAN EXPOSURE CONTROLS FOR PUBLIC INFORMATION

The information provided in this chapter will assist the owner of a structure in the Central Pine Barrens to prepare for a wildland fire. Fire departments are encouraged to conduct walk throughs within their districts to assist owners in making their structures "fire resistive".

5.1.1 Defensible Spaces

The following excerpt from Wildland/Urban Interface Protection, a textbook produced by the Federal Emergency Management Agency (FEMA), provides a comprehensive discussion of the importance of defensible space:

> "There is one general protection strategy that has proved its effectiveness in every locality. This is the concept of "defensible space". Defensible space is a simple strategy. It involves providing sufficient space between the structures and the wildland's flammable vegetation within which the fire service can mount a defense against fire. Within this space, the fire service has room to battle oncoming wildfire before it reaches structures or to stop a structural fire before it ignites the wildland vegetation. With sufficient defensible space, the structure even has a chance to survive on its own when fire service personnel and equipment are not available - as often happens during a significant interface wildfire.
>
> Defensible space can be nothing more than a minimum 30- foot clearance between homes and flammable vegetation or as complex as a series of green belts (or fuel breaks) surrounding a planned community. Creating defensible space provides the firefighter with a line of defense against fires - an opportunity to stop their spread. Defensible space in the wildland/urban interface can be compared to the first line of attack in a battle. It is here that firefighters have the best chance to stop the enemy and win the war.
>
> Defensible space is only one of a number of protection strategies, but it incorporates a number of additional options that we will be discussing in this text. What is most important about defensible space is that it accomplishes three critical objectives. First, creating defensible space can help prevent serious fires from ever starting. By understanding and implementing defensible space (considering issues such as flammable vegetation, building materials, access, water supply, etc.), homeowners, city planners, architects, and others will be building houses and communities that are more fire-safe and thereby reducing the hazard from fires. Secondly, if fires do occur, defensible space provides the fire service with the "fighting chance" to stop it quickly and efficiently and to reduce the tragic costs in property, natural resources, and lives. Thirdly, with adequate defensible space, there is the chance that a structure can survive on its own - when fire service resources are strained and no immediate help is available".

Specific recommendations for defensible space suggest that it should extend for a minimum of 30 feet from a structure. Within this 30 foot area there should only be trees and shrubs that are drought and fire resistant. Trees should be pruned six feet up from the ground, grass growth should be cut and not more than six inches high. There should be no vegetation or combustible storage under decking, no aerial canopies within 10 feet of the chimney spark arrester, and no storage of fire wood within 10 feet of the structure.

The consideration and implementation of defensible space strategies should be based on area specific urban interface mapping and site specific hazard assessments. In addition, to ensure maximum fire protection and minimization of conflicts, the development and implementation of specific defensible space strategies should be coordinated among all pertinent local, municipal, county, state and federal fire protection, planning and regulatory agencies, including those having jurisdiction over land use, zoning, construction and land management.

5.1.2 Size-Up of Structures/ Determining Total Hazard Ratings

Fire departments and owners of structures should conduct a size-up of structures to determine what can be done to reduce the structure's risk from a wildland fire. This involves assessing total hazard ratings on a very detailed level within the wildland/urban interface; perhaps to a level of individual structures or small groups of homes.

A total hazard rating for a structure of group of structures is assigned based upon a number of factors, including the structures themselves (flammability of roof and siding), natural fuels (the type of wildland), and slope of the land. A guide developed by FEMA is provided in Appendix C for assessing the interface in this way (FEMA, Wildland/Urban Interface Protection).

The hazard assessment identifies priority problem areas along the interface. Once identified, action plans can be developed to reduce risks and formulate protection strategies. Risk reduction can include fuel (vegetation) management, making structures more fire resistant, and/or increasing defensible space. Protection strategies would include activities such as predetermining the type and amount of equipment and personnel which would be required in a specific area (or at a specific structure) in the event of a wildland fire.

A desirable and natural outgrowth of this assessment process would be accomplishing risk reduction to reduce the amount of equipment and personnel necessary to protect property and life. As noted above, the risk reduction effort should be coordinated with all pertinent local, municipal, county, state and federal fire protection, planning and regulatory agencies, including those having jurisdiction over land use, zoning, construction and land management.

5.2 FIRE PROTECTION ASSESSMENT PLANNING

Fire Protection Assessment (FPA) planning is a comprehensive tool which results in a more efficient use of resources through the integration of fire prevention actions, suppression strategies, fuel management and fire administrative needs. The methodology has been developed by many individuals over the past decade and has been implemented in the San Bernardino National Forest, California, statewide in Colorado, Kauai, Hawaii Department of Land and Natural Resources and in several Michigan fire districts. Fire planners and managers in other regions are learning about FPA and considering the use of this powerful tool to aid in all aspects of fire protection.

What is the purpose of doing a fire protection assessment?

- foster interagency communication
- quickly identify areas that may require additional tactical planning
- identify possible alternative suppression opportunities
- identify critical natural resource management needs
- communicate fire management needs and funding requirements to policy makers, and stakeholders

What is the expected result of a fire protection assessment?

- efficiency in sharing expertise and fire resources
- a strategic and tactical fire protection plan that is dynamic and refined as new information is learned
- a better understanding of what is happening on the ground
- common language, common goals
- documentation for fire suppression and management decision making

What is the process of doing the assessment?

An independent analysis of the following:

- Risks - determine potential ignitions and where they are likely to occur such as industrial land uses, all terrain vehicle (ATV) use, wildland-urban interface, camping areas and other areas of high risk activities. (fire history information is useful in determining risks)
- Hazards - determine areas where fire behavior, intensity and rate of spread are similar and can be predicted. Possible criteria for this analysis include vegetative cover types and ages, topographic characteristics, accessibility and weather events.

- Values - identification of human and natural resource protection priorities such as housing developments, wildlife habitat, rare and endangered species, scenic values, cultural resources, etc.

Risks and hazards are each categorized on a minimum of three levels (high, medium and low) and are mapped separately, if possible, utilizing a Geographic Information System (GIS). Values, as defined previously, are mapped, however, instead of rated, to determine each value's protection needs and requirements. Upon completion of each level of analysis, prepare a landscape description that explains why and how each area was given a particular rating. The process can be started using available data and can be refined as new information is gathered.

- Aggregation - Overlay risk and hazard maps and see where the fires are most likely to occur and how intense they will be. Overlay values with risks and hazards and learn where the protection priorities are located in areas where the risks and hazards are high. The result of this process will be specific "landscape compartments" or fire management analysis zones (FMAZ).

How do you develop the final product or fire management action plan?

Based on protection priorities, prepare a fire management prescription which specifies the following for each FMAZ and then identify what agency or individuals can achieve specific activities.

- fire prevention actions necessary to prevent ignitions from occurring in and around values which cannot interact with wildfire
- pre-suppression opportunities including detection training, equipment and planning needs
- suppression opportunities - appropriate strategies to confine, contain and control wiildfires.
- vegetation (fuels) management needs to reduce fire intensity

The fire protection assessment should be kept as part of the local pre-fire assessment plans. These plans should be updated as warranted. The FPA is a total fire management tool that can be applied at a strategic or tactical scale and should include all stakeholders to successfully result in common understanding, common vision and closer working relationships.

5.R RECOMMENDATIONS

- By the summer of 1999, offer a training course in Wildland/ Urban Interface planning using the FEMA textbook and course materials as a basis.

- By the fall of 1999, conclude the mapping of the wildland/urban interface in the Central Pine Barrens and commence detailed hazard assessments for the wildland/urban interface consistent with the FEMA text and other information sources as may be identified.

- Implement action plans to reduce risk to life and property identified during the interface mapping and hazard assessment. Coordinate this effort among all pertinent local, municipal, county, state and federal fire protection, planning and regulatory agencies, including those having jurisdiction over land use, zoning, construction and land management.

- By the fall of 1999, initiate the development of a Fire Protection Assessment to determine the needs, targets and recommendations for wildland fire suppression in conjunction with the fire departments. This assessment will be for the entire Central Pine Barrens first and then, if individual fire departments are interested in such a plan, a more detailed assessment will be prepared for their areas.

CHAPTER 6: FIRE SUPPRESSION

6.1 INTRODUCTION

Wildfires can be suppressed using a variety of strategies including confinement, containment and control. These strategies utilize the tactics of both direct and indirect attack. Control strategies with direct attack tactics and heavy reliance on mechanized equipment are the current means used by most fire departments in suppressing wildfires in the Central Pine Barrens. Most departments within the Central Pine Barrens use the Incident Command System (ICS) with heavy dependence on mutual aid assistance. Mutual aid response is coordinated through the Suffolk County Fire, Rescue, and Emergency Services Department. This plan recognizes the success that this well established structure has for suppressing wildfires within the Central Pine Barrens.

Full suppression should remain the standard for areas where wildland and development areas meet, when fires threaten residential areas, and when human life and property are in immediate danger.

6.2 RESOURCES

Most wildfires within the Central Pine Barrens are handled with a modest amount of suppression resources, provided by the fire district in which the fire occurs and local mutual aid. These incidents are typically less than three hours in duration and do not require any special resources or elaborate requirements for rehabilitation ("rehab"), liquid refreshment or nutrition. The mutual aid requests are processed by the Suffolk County Department of Fire, Rescue and Emergency Services (FRES) Communication Center in Yaphank, which maintains a current database of all available apparatus and special equipment.

Additional resources may be needed for larger or unique incidents. A list of available resources used for firefighting is included in Appendix D.1. This list includes nontraditional firefighting equipment, specialized firefighting equipment and other equipment needed to control a wildland fire. This list should be modified to fit local needs and to include specific information about local vendors. It is recommended that the fire chief prepare this local resource list in cooperation with his Board of Fire Commissioners. The list should be reviewed periodically, and updated as needed, to ensure accuracy when needed for an emergency.

For very large incidents, involving Countywide response and lasting more than eight hours, additional provisions must be made for extensive rehab and personnel rotation (provision for meals, bathroom facilities, etc.). Also, provisions must be made to allow for relief and rotation of personnel in all key ICS functions. Logistics problems are not often experienced with Suffolk County incidents, but nonetheless are an important component of the Logistics Group in the Incident Command Structure. This ICS section is best handled under the direction of at least

one chief officer who should coordinate expenditures with a representative from the Board of Fire Commissioners.

The Central Pine Barrens Wildfire Management Task Force has also been working with local, County and State government officials to make other special suppression equipment available to the local fire chief. These special resources include helicopters with "water drop" capability and availability of "hand crews" for support during suppression and mop-up operations. Once agreements and procedures for obtaining access to this equipment is finalized, information will be distributed to all fire chiefs and commissioners for their use.

6.3 SIZE-UP AND INCIDENT CLASSIFICATION

6.3.1 Size-Up

Size-up of a wildland fire is just as important as size-up in a structure fire. The Wildfire Task Force has developed a size-up system for wildfires that uses the national system[3] but incorporates local knowledge and conditions. Appendix D.2 contains a simple wildfire size-up form that will assist the first arriving officer in determining the extent of the fire, and recording pertinent information. This form will also assist the Incident Commander in performing future size-ups as required throughout the incident. It is recommended that a size-up of the fire occurs upon arrival and then update every fifteen (15) minutes until the fire is contained, thereafter, every thirty (30) minutes until the fire is controlled, and at least once each eight (8) hours until the fire is extinguished.

The Size-Up Form found in Appendix D.2, assists with recording specific fire data identified in Table 6.1.

[3] Fireline Safety Reference Booklet, National Wildfire Coordinating Group

Table 6.1: Summary of Data Recorded on Size-Up Form	
Fire Data	**Description**
Date and Time	Self explanatory.
Location	Street location of fire.
Size	The size of the fire is recorded in terms of number of acres involved on arrival of first unit and at time of updates.
Rate of spread	Recorded on arrival and at time of updates as fast, medium or slow.
Exposures	Identifies the type of exposure: residential, business or hazardous materials and time until threatened.
Firebreaks	Identifies trails, roads or cleared areas that can be used as firebreaks or firelines.
Fire behavior	Type of fuel [grass, slow woods (such as oak and locust) or pines] and type of fire (ground, surface or crown)
Weather conditions	Temperature, wind speed, relative humidity and wind direction
Fire weather index	This is a scale and explanation of the fire weather conditions for the fire location disseminated by Suffolk County Fire Rescue and Emergency Services, obtained at the time of dispatch and updated as required. It includes information on the 10 hr. fuel moisture content and drought index.
Fire classification	Type IV - Responding Department & up to 3 Mutual-Aid Departments. Type III - Responding Department & 3-10 Mutual-Aid Departments. Type II - County Wide Resources are needed, most ICS positions are filled. Type I - State and Federal Resources are needed - ALL ICS positions are filled by most qualified personnel. Each classification indicates the level of equipment, manpower and mutual aid (local, county, state and/or federal) required in addition to the responding department to control and extinguish the fire. Type I represents the most severe case where state and/or federal aid is required to control the fire. An exception to this would be the use of state helicopter resources which may also be employed under Type II and III without reclassification to a Type I.

6.3.2 Incident Classification

The second part of the Size-Up Form, identified as the Wildfire Checklist in Appendix D.3, will assist the first arriving officer in determining strategies and tactics. This section of the form assists the Incident Commander with the paper work needed for reporting requirements and also with determining the resources required to contain, control and

extinguish a wildland fire. This form provides information and collects data on the items identified below:

- **Strategy;** Determine if the attack on the fire will be Offensive or Defensive; Direct- Aggressive; Direct-Flank; Indirect-Defensive.

- **Checklist for items to be completed and reviewed for each Fire Classification;** A checklist to remind the Incident Commander of items that need to be completed during the alarm.

- **Fire weather Index:** This is a scale and explanation of the fire weather conditions for the fire location disseminated by Suffolk County Fire Rescue and Emergency Services (SC FRES). The fire weather index will be an qualitative description, with the actual components available to the fire chief or officer upon call in to the SC FRES dispatch center. The fire weather index and fire weather are generally described in Section 3.4.

6.4. STRATEGIES AND TACTICS

6.4.1 Strategies

Following size-up, the first arriving officer should follow the recommended guidelines below to establish an Incident Command System (ICS) and the staging area, determine strategies and tactics for effective fire suppression (keeping in mind firefighter safety), while minimizing the impact of suppression strategies and tactics on the local ecology.

1.	**Establish Incident Command System (ICS)**
•	Fill key positions with experienced officers and/or mutual aid chief officers
•	Request Mobile Command Post (if required)
Note: It is recommended that a unified command be established to integrate all involved agencies. The IC should be the senior officer of the district where the fire started. The IC can and should transfer the IC authority when the fire and associated emergency is no longer active in his district but remains an emergency or threat in another fire district. Transfer of command should take place only when it is practical to do and face to face. In fast moving incidents, this requires agreement that the initial IC will remain in command, even as the fire spreads into an adjoining district(s).	

2. Establish Staging Area and Assign Staging Officer

- Form "strike teams" as appropriate composed of brush trucks, engine companies, tanker crews, combination of units. See Appendix D.4 "Staging Area Form".
- Each strike team should be briefed on the situation (size-up), their assignment objectives, command and communication issues and where to report at completion of assignment. See Appendix D.5 "Wildfire Briefing Form".
- A strike team leader should be assigned by the Operations Officer.
- An "Emergency Only" frequency should be assigned and made known to all strike team leaders.
- Accountability tags will be left with the Staging Officer and picked up after each assignment. If tags are not carried by an arriving unit, the Staging Officer will complete and hold a "Crew Log" for that unit.
- Consideration should be given during high fire weather index days to "pre-stage" equipment at locations favorable for dispatch to wildland fires, this will assist in reducing response time to the alarm and location.

3. Determine Strategies To Be Used

- There are two strategies to consider offensive or defensive attack. Consideration must be given for the urban interface - assigning engine company strike teams, evacuations.
- The need to constantly review conditions and effectiveness of attack versus the resources on hand. Change strategies, tactics or resources when conditions warrant, re-evaluate using the "Size-Up Form".
- When considering the strategies and tactics to use during the course of the firefight, consideration should be given toward the protection of the wildland environment. Tactics friendly to the environment should be used when conditions warrant.

4. Determine Tactics To Be Used For Firefighting

- Direct - Aggressive (local terminology): Used for ground or surface fire characterized by a small area, a slow moving fire and low flame heights only. This involves using brush truck strike teams deployed to and working at the head of the fire for suppression, using water or Class "A" foam.

- Direct- Flank (local terminology):
Used for ground or surface fire characterized by a large area, fast moving fire and medium flame heights. This involves using brush truck strike teams deployed to anchor and flank the fire for suppression, using water or Class "A" foam.

- Indirect- Defensive (local terminology): Used for a crown fire characterized by a large area, a fast moving fire and high flame heights. Brush truck strike teams are deployed to widen firebreaks. It involves the cautious use of an anchor and flank strategy, always leaving escape routes to control the flanks of the fire. Attempt to halt the head of the fire at large firebreaks by the use of brush truck strike teams and/or engine tanker strike teams. Deploy brush truck strike team for "brand patrol" (local terminology) downwind of the firebreak.

- Urban Interface Protection: accomplished by the use of engine tanker strike teams to protect structures as resources allow. See Exposures section of "Size-Up Form".

- Fuel removal: Accomplished by the use of bulldozers to cut firebreaks, consideration should be given to their use at night due to reduced fire conditions and consider assignment of fire band radios.

  Fire apparatus are assigned to large firebreaks in defensive mode. Brush truck strike teams are used to protect bulldozer operations and for "brand patrol" downwind of the fire.

- Special Operations: These include helicopter water drops (e.g., NY National Guard or other agencies, possibly private resources), New York State Department of Environmental Conservation (NYS DEC) and/or fire department hand crews and other resources. Special operations may be accomplished by the use of Class "A" Foam for protection of structures, firelines and line firing operations.

5. Follow Established Fire Safety Strategies

- Firefighter Safety - Firefighter safety has long been a primary concern for wildland firefighters. However, multiple fatalities over the last several years nationwide have sparked a renewed emphasis in this area. The key message is:

  No wildfire, even those that threaten structures or improvements, is worth risking death or injury.

  Staying safe at a wildfire means that fire personnel are aware of and monitor, environmental factors that include fuel characteristics, fuel moisture, fuel temperature, terrain, wind, atmospheric stability and fire behavior. There are indicators for each of these factors and their interactions that affect fire behavior and therefore firefighter safety. Select effective suppression tactics considering observed and expected fire behavior.

  The safety system called: Lookouts, Communications, Escape Routes, Safety Zones (LCES) highlights the most critical components of fireline safety. It emphasizes the following:

  - Focus on the essential elements of the Ten Standard Fire Orders (See Appendix D.6)
  - Brief all personnel on escape routes and safety zones well in advance. As conditions change, there may be a need to change escape routes and safety zones. If this occurs, others must be notified. LCES must be established before they are needed.
  - If escape plans include the use of vehicles, the vehicles should be pre-positioned with drivers.
  - Indirect line construction needs to have well scouted safety zones.
  - Select an experienced, trusted firefighter as a lookout and insure dependable communications systems are in place.
  - If escape routes and safety zones are needed, think clearly and act decisively. Panic leads to trouble.

5. Follow Established Fire Safety Strategies - Continued

The National Wildfire Coordinating Group (NWCG) publishes the Fireline Safety Reference Booklet (NFES 2243) that summarizes the basic elements of wildfire safety concepts. It includes the following:

- Look Up, Look Down, Look Around: Fire Environmental Factors and Indicators
- Lookouts, Communications, Escape Routes and Safety Zones (LCES)
- 10 Standard Fire Orders
- 18 Watchout Situations (Survival Checklist)
- Indirect Line Construction Guidelines
- Common Denominators of Fire Behavior on Tragedy Fires
- 9 Urban/Wildland "Watchouts"

- Safety Zones: Safety Zones are set up to protect firefighters in case the main body of the fire changes direction and/or starts to move quicker than expected. These areas should assist in protecting firefighters and equipment in the path of a fire by lowering the intensity of the fire. Safety zones should be set up prior to an actual fire occurring. Departments are encouraged to pre-plan districts to layout these safety zones. These zones should be areas that are relatively free of high tree cover and have low flame spread.

  During actual fire operations, mutual aid departments should be briefed on the locations of these safety zones prior to equipment being committed into operation. These briefings should occur at the same time they are given the assignment form, or this can be done when the equipment is assigned into the staging area.

  Sector officers and officers of equipment in operation during a large fire should constantly be aware of safety zone locations in the area in case they are needed.

6. Rehabilitation (Rehab) and Relief Operations

- The IC should establish a rehab area for all major incidents to ensure firefighter safety and health. This area should be physically located adjacent to the Staging Area. The Rehab area can be assigned to and performed by Community Ambulance Companies who are called upon to supply standby ambulances.

- Plans should be made to relieve crews as necessary. Relief should be done at the Staging Area and all crew changes should be documented with the Staging Officer who is holding accountability tags.

7. Resources and Logistics:
As part of the ICS, a Logistics Officer should be assigned to begin work on procurement and set up of anticipated support items, such as: • food and liquid refreshments • bathrooms • enlarged command center and meeting area • fuel and gasoline supplies • spare parts and mechanics • any other items needed by the IC to extinguish the fire • Class "A" Foam

6.4.2 Minimum Impact Suppression Tactics (MIST)

The use of MIST is discussed in this subsection as it relates to Long Island wildfires and brush truck operations. MIST is NOT a separate classification of wildfire suppression tactics or strategies. It is simply a "mind-set" of how to suppress a wildfire while minimizing the long term effects of the suppression action. This concept also extensively reduces wear and tear on the brush trucks, bulldozers and fire plows, as well as the number of breakdowns experienced.

The concept of MIST is to use the minimum amount of apparatus and heavy equipment necessary to effectively extinguish the fire and to take into account ecosystem management objectives when establishing suppression tactics. For Long Island, which has extensive wildland-urban interface zones, it is recognized that an *aggressive attack* is necessary for protection of lives and property. There are, however, several simple guidelines that follow the MIST concept while using aggressive suppression tactics. *Firefighter safety*, as always, remains the highest priority. Identified below are examples of how MIST can be used in firefighting situations.

- Use natural breaks, trails, right-of-ways, etc., when available for brush trucks, and/or bulldozers, to drive to the fire area. This reduces the wear and tear on the equipment, and long term damage to the environment. Have all brush trucks follow the same access route unless a better route is found.

  This DOES NOT mean that brush trucks can not make a path to the fire if that is the only way. This DOES NOT mean that fires must be allowed to burn to the road.

- Have brush trucks stay in line and attack fires in tandem at the perimeter, starting with an arch or point on the flank. Try to limit "crisscrossing" of the fire area during mop-up. The use of booster lines and forestry hose to do one hundred percent of the mop-up of the perimeter (and 20-50 feet from the perimeter) reduces both truck and environmental damage. More brush trucks break down, or get stuck on mop-up than during actual suppression of the head of the fire.

  The more vehicles "crisscross" the interior of the fire, the more likely fire brands could be picked up by these vehicles and potentially deposited outside of the burn area. This increases the likelihood of re-ignition after the fire department leaves the scene.

- Drivers should drive around as many trees as they can. Each tree that is knocked over creates wear on the truck, becomes a hazard for other trucks, adds to the fuel load on the ground for future fires, reburns, and increases mop-up time and reburn occurrence.

- Use the "wet-water" or environmentally safe Class A foam to make mop-up efforts more effective. This reduces the time brush trucks and firefighters need to remain on the scene.

- Use Global Positioning System (G.P.S.) tracking and/or police helicopters to locate fires and to direct units to the fire, as opposed to "searching" for fire by using brush trucks in a random search.

- Use bulldozers or fire plows to construct a fireline, when necessary, to suppress and mitigate a wildfire, not to scarify the soil as an overall fire mop-up technique.

6.5 MOP-UP AND PERIMETER CONTROL

Effective mop-up and perimeter control must be started as soon as possible to secure firelines from the point of fire origin. The IC should assign a Chief Officer as the perimeter control officer. The use of brush truck strike teams should be considered for this operation prior to bulldozers to protect the woodlands from further damage. Units should secure the perimeter and not be overly concerned with small internal fires. A fireline should be created and held to contain the fire and finally extinguish it. The use of hand crews can also be of value when difficult terrain or limited equipment exists.

The use of burnouts of unburned fuel inside the perimeter is an effective method of controlling the perimeter to limit the chance of internal fires gaining the headway needed to breach the perimeter. The IC will need to determine, based on existing predicted local weather conditions, whether or not burnouts can be used.

6.R RECOMMENDATIONS

- Educate and train fire departments on the use of the developed forms for fire size-up and the wildfire checklist (see Appendices D.2 and D.3).

- Establish, in writing, the protocol for requesting the use of a helicopter for aerial suppression support through the State Emergency Management Office, the NYS DEC, the NYAir Guard, or the NY Army Guard units.

CHAPTER 7: COMMUNICATION

7.1 COMMUNICATION GOALS

The key to success in any major incident is the ability of the communications effort to succeed. Historically, communications have been difficult in any major incident. This chapter identifies the existing communication difficulties that are encountered during major emergencies (such as the 1995 wildfires), examines the causes of such difficulties, and provides short and long term recommendations to resolve these issues.

7.2 RADIO COMMUNICATION

7.2.1 Existing Communications Conditions and Difficulties

Existing communications is scattered throughout the various radio frequency spectra. Fire departments operate mostly on Low Band VHF, non-repeated, with limited mobile coverage and very limited portable coverage, but with very good ability for inter-operation. However, this band is quickly overwhelmed during major incidents. A few use High Band VHF or 400 MHz. They have better coverage and are generally not overwhelmed, but have little, if any, ability for inter-operation.

Ambulance companies (other than those which are part of fire departments) are primarily on High Band VHF, that has limited mobile coverage, but very good ability for inter-operation. However, this can be overwhelmed during major incidents. Like fire departments, several use 400 MHz.

Town agencies use High Band, 400 MHz and 800 MHz-trunked. Coverage is good town-wide, but has limited ability for inter-operation. County agencies (other than police departments) use a High Band VHF system with county-wide coverage, also with limited ability for inter-operation. Many agencies will become part of Suffolk County Police Department's 800 MHz system in the future.

Police departments operate on, or will have access to, the Suffolk County Police Department 800 MHz-trunked system. This system has excellent mobile coverage and good ability for inter-operation. This system should not be overwhelmed by significant events.

State agencies use High Band VHF. Coverage can be state-wide, but the ability for inter-operation is limited to state agencies. Federal agencies use High Band VHF, 400 MHz, 800 MHz and 900 MHz with no known ability for inter-operation.

7.2.2 Causes of Communications Difficulties

During major emergencies, numerous fire departments, police departments, town, County and State agencies, as well as other support entities, are required to manage the incident. Hundreds of apparatus, units and portable radios are all vying for the limited "air time". This competition leads to missed and distorted messages and less than efficient use of resources, often exacerbating the problems of already taxed communications and frustration of the users. In some cases, urgent requests for help are delayed, garbled or unable to be acknowledged.

Numerous communications systems, as identified in Section 7.2.1, have been developed by the different agencies that handle disaster situations to meet their individual agency requirements, and available financial resources. Although these varying systems are adequate for the routine functioning of a respective agency, they can cause complications when trying to talk to an "outside" organization.

The results of these two situations are that the numerous components critical to successfully concluding an emergency are not generally well coordinated due to these communication problems.

7.3 FUTURE ENHANCEMENT OF COMMUNICATIONS SYSTEMS

There is a need to develop a solution to the communication problems identified in this chapter to ensure all agencies involved in emergency situations are able to communicate effectively with all parties. The Suffolk County Police Department appears to have the best system currently available in relation to coverage, reliability and inter-operability. Their willingness to share a portion of this system's resources and abilities with other municipal agencies makes it the most likely candidate for reliable communications among multiple agencies, however, it is important to remember the following facts about this new system:

1. If all fire departments and emergency medical service (EMS) agencies were to regularly access the system as designed, it would be quickly overwhelmed during routine operations. Public safety would be compromised on a daily basis.

2. There are not enough 800 MHz channels available to support a single county-wide trunked system for all agencies/disciplines (fire departments, police departments, EMS, and local government).

Therefore specific recommendations are made in the following subsection to optimize future communications in emergency situations.

7.R RECOMMENDATIONS

7.R.1 Short Term (Immediate) Recommendations

An interim, cost effective solution must be forthcoming to have reliable communications, at least for all key personnel during significant emergencies. The following actions are recommended:

- Confirm with the Suffolk County Police Department 800 MHz radio system manager the talk group(s) that will be used during times of major wildfires, as well as assigning a talk group for the routine operations of Suffolk County Fire Rescue and Emergency Services (SC FRES). This may include one or more disaster talk groups to be activated only during major incidents.

- Obtain and distribute the procedure by which the Commissioner of FRES will authorize various fire, EMS or other entities to access the talk group(s) and when the disaster talk group(s) will be activated.

- Seek to acquire portable radios and accessories on the Suffolk County Police Department 800 MHz system to use at major incidents. These radios shall be charged and stored in a suitable, centrally located facility (the SC FRES Command Van if possible), for ready distribution when needed. Upon request of the Incident Commander, the portable radios would be transported to the Command Post and would then be assigned to various sector and branch commanders, strike team leaders, and others as deemed necessary by the IC.

  The other agencies (police departments, other County agencies, and town agencies so equipped) who have the capability of operating on this system would switch to the assigned talk group as needed. It is not intended that all fire ground operations take place on this system. To the contrary, only key personnel, in charge of the various sectors and branches, and strike teams would operate on this system. With this arrangement, while there would still be innumerable radio frequencies utilized, at least the sector/branch/strike team commanders would have the ability to communicate reliably with each other. Each commander would still have to maintain adequate radio contact with the resources under his/her command.

- It is absolutely vital that adequate training in proper radio use and discipline be implemented. Keeping messages clear, concise, and transmitting only pertinent information is paramount!

- Discontinue the use of all codes, signals and numerical identifiers and use plain language to eliminate confusion, especially on the part of individuals of differing disciplines.

- The Communications Committee of the Wildfire Task Force recommends that the Training Committee consider the addition of training on "Communications Discipline and Protocol".

- Provide a copy of this Wildfire Management Plan to the Suffolk County Combined Radio Committee for their information and use.

- Seek to acquire the necessary apparatus and equipment such as Global Positioning System (G.P.S.) equipment to assist in locating units in trouble and to accurately locate fires for reporting purposes.

- During major emergency events, when the normal cellular telephone network may become overwhelmed and of limited value, additional cellular telephone services will be made available upon request of the SC FRES Commissioner through prior arrangements made with cellular telephone service providers. This may include temporary cell sites, "loaner" portable cellular phones, etc.

7.R.2 Long Range Recommendations

- In the very near future, the fire service as a whole must make a decision as to how to improve their communications. A full study of available options and costs must be undertaken. The Suffolk County Combined Radio Committee has been assigned by SC FRES to review current and future communication systems. Available frequencies in every part of the spectrum are quickly licensed by other interests. It is reported that frequencies in the 700 MHz range may become available. This block of channels should be investigated for possible use by the fire service. The use of a trunked system will almost assuredly be required. The consideration of a "Smart Net" type system, where units are assigned talk groups automatically, as needed, without operator intervention, is highly recommended. Inter-operability, at least among the fire service, is essential.

- With the vast quantity of fire department radios in service, a very large capital expenditure would be necessary to change the fire departments to any other system. Funding options and sources must be researched and obtained.

- Continued education and monitoring for proper radio use and discipline must be ongoing. Serious consideration must be given to some type of required corrective

action for chronic abusers. Reliance upon the Federal Communications Commission (FCC) or others to insure the proper use of the radio system would be ineffective and less than professional on the part of the users. Self policing is ultimately more desirable.

CHAPTER 8: POST FIRE ACTIVITIES

8.1 OVERVIEW OF POST FIRE ACTIVITIES

Post fire activities can range from the very simple to the quite complex, depending on the size of the wildfire incident. With that in mind, the Incident Commander (IC) must choose an appropriate strategy to address all aspects of the post fire activities. The purpose of this chapter is to provide a framework for the IC to assess their needs before and during recovery operations.

There are four basic categories that make up the components of post incident operations:

- Financial, which is broken down into community and emergency agencies;
- Psychological, which is broken down into emergency responders and community;
- Operational, which deals with infrastructure and emergency agencies; and
- Rehabilitation of ecological damage which involves restoration initiatives after a wildland fire.

The recovery process has two time phases, short term and long term. The short term phase includes: preliminary damage assessment, debris clearance, temporary repair of infrastructure and utilities, and immediate aid to individuals (shelter, food, sanitation, crisis counseling and financial). The long term phase includes: acquisition of financial aid, reconstruction of infrastructure and utilities, review of preventive legislation, zoning and building codes, and improvement of emergency response capability.

For these operations to be effective, it is necessary that communications are established and maintained. The public and responding agencies should be made aware that these systems are in place and available to those requiring assistance. The various types of assistance available may not be under the control of the fire department or district that has responsibility for the incident, however, the community affected and the responding agencies will look to that agency for information regarding recovery operations. As the level of operations expands, the share of financial responsibility may move from the local level to the state and/or federal level. Written procedures will provide a smooth transition from one level of financial assistance to the next. Further, these written procedures should define the documentation needed to obtain assistance at any given level.

8.1.1. Financial

Financial aid in recovering from an incident may be available from private (insurance), local, state, or federal sources, depending on the incident scale. As with any incident, the importance of documentation of all actions is essential in recovering funds.

The private sector may involve a community member, the fire department or district depending on the nature of the loss incurred. Each fire department or district should have available: the name of the firm holding the insurance policy, the telephone number of the insurance company's office or representative, and what is covered by the insurance company (equipment, medical coverage, death benefits).

Table 8.1 identifies the type of assistance available from local, state and federal government sources, along with potential costs that may be recovered and documentation required. Government aid depends on the nature of the incident.

Table 8.1: Financial Assistance Available From Government Sources	
Source of Assistance	**Type of Assistance Available**
State and local government aid	Low interest loans, grants, tax relief and the loan of equipment on an emergency basis.
Federal relief - available through the Disaster Relief Act of 1974 (Public Law 93-288).	Relief available to the community includes: ▸ Temporary housing [Federal Emergency Management Agency (FEMA), Red Cross, Salvation Army] ▸ Disaster loans (Federal Small Business Administration) ▸ Individual and family grants (FEMA) ▸ Agricultural assistance (Farmers Home Administration) ▸ Disaster unemployment assistance (U.S. Department of Labor) ▸ Legal services ▸ Federal tax assistance (Internal Revenue Service) ▸ Aid to the elderly (Social Security Administration) ▸ Volunteer assistance (Red Cross, Salvation Army) ▸ Highways (U.S. Department of Transportation) ▸ Schools (U.S. Department of Education)
Potential Costs That May be Recovered	**Documentation Required to Obtain Assistance**
Damaged apparatus and equipment: ▸ Fire stations ▸ Maintenance facilities ▸ Communications centers ▸ Apparatus ▸ Operational equipment Infrastructure on which the agency relies: ▸ Roadways and bridges ▸ Water supply systems ▸ Utilities ▸ Communications services	▸ Manpower overtime ▸ Apparatus and equipment damage ▸ Above normal usage of apparatus and equipment ▸ Fuel utilization ▸ Supplies used or damaged ▸ Administrative costs ▸ Purchasing ▸ Vendor Payments ▸ Legal Services

8.1.2 Psychological Aspects

In large scale, high intensity or long term operations, there may be a need to help both victims and responders to recover from the psychological effects from the incident. These effects, both short and long term are important considerations for responding agencies in maintaining an effective core of personnel. It is also important to the community that the victims are given proper care and support.

Agencies available to provide help in this area:

- National Organization for Victim Assistance.
- Emergency Responders - Critical Incident Stress Debriefing - This type of relief should be considered in operations where there is a line of duty death, serious line of duty injury, emergency worker suicide, disasters, mass casualty or death, serious injury or death to children, events where victims are relatives or friends and events that seriously threaten the lives of responders.

These type of events may be of such a nature that they are detrimental to the psychological well being of emergency responders and may therefore reduce their effectiveness in dealing with future emergency situations.

8.1.3. Operational Recovery & Evaluation

One of the major considerations in operational recovery is that the incident itself must be handled in a smooth and efficient manner. A primary problem that occurs, both during and after the incident, is convergence. Convergence is the massing of people at the incident site. These people can come from two areas: the general public (e.g.; curiosity seekers, individuals who desire to be part of the incident, volunteer assistance) and the news media (e.g.; reporters who want to report the news, get the story first or get an exclusive).

The likely presence of media at an incident requires anticipation of their arrival and an understanding of their function. A responsive media briefing center and a Public Information Officer (PIO) to address media concerns should be provided. This prevents the need for moving media scattered over a wide area to a central location, it provides accountability and allows the PIO to operate effectively. The designation of a PIO:

- provides for the safety of the media, because frequently they do not understand the dangers inherent in an incident,
- makes sure the media center location is known to the press, radio and television reporters, and

- Provides a source for timely and accurate updates of the incident and when it is safe, provides a guide for tours of the incident.

The purpose of an operational evaluation is to examine the effectiveness of operational planning as applied to the incident. It must be emphasized that its purpose is not to fix blame on any person or agency for any perceived problems that may have occurred during the incident. It is a systematic review of the incident for the purpose of identifying strengths and weaknesses in planning and management, with the goal of reinforcing the strong aspects of the plan and mitigating the weaknesses.

Appendix E contains a post-incident checklist which is useful in preparing for these activities.

8.1.4. Rehabilitation of Ecological Damage

The need for restoration initiatives after a wildland fire is important to the public landowners in the Central Pine Barrens. It is recognized that suppression efforts must, in some cases, damage the natural environment, however, the resultant management impacts are left to the landowning agencies for a long time to come. For instance, new firebreaks and or fire roads create new access points for illegal users. Land managers and law enforcement officials are continually struggling to limit illegal access to public lands by off road vehicles. Such illegal use not only ravages the natural environment but it also encroaches on the use of public lands by legal users such as hunters, hikers, bikers, etc.

For the enforcement agents, landowners and the public at large, this issue has become increasingly widespread and hence problematic for the use and enjoyment of these areas and financially draining for the limited staff at these agencies. Additionally, and equally important, the ecological effects of new disturbances are also negative in that they increase forest fragmentation, allow for the colonization of exotic species and generally destroy intact habitat. These effects are far-reaching as such disturbances cannot be easily remedied and the negative impacts can endure well into the future.

There are mitigation measures that can be implemented. One such example of wildland fire restoration is through the Global Re-Leaf Program sponsored by American Forests. A grant from American Forests was received for a three year period following the Rocky Point and Sunrise Fires of 1995. The grant allocates 15,000 tree seedlings per year to be replanted in areas that were cleared for firebreaks. The planting started in the spring of 1997 and will continue through 1999. The recipient of this grant was Suffolk County Community College and through the grant coordinator, several hundred volunteers were organized to plant the seedlings. Many of the cuts that were made have now been blocked from access and will have the opportunity to recover. To utilize programs such as this, it is

recommended that the land manager undertake the post fire activities, include an assessment of damages to public lands and what is needed to repair or restore them.

8.2 PINE BARRENS FIRE REPORTING

The creation of a central database to track and record vital information concerning all fire activity within the Central Pine Barrens would provide many benefits. These benefits include:

- Fire chiefs and fire investigators will be able to get an accurate and encompassing set of statistics that may prove extremely beneficial in preventing unintentional wildfires and/or allowing for apprehension and prosecution of suspected arsonists.

- A central database would provide accurate information that could efficiently identify "problem" areas (i.e. unlawful access, stripping of stolen vehicles) which may be beneficial to local law enforcement agencies and/or the Law Enforcement Council. The information may also help to identify "security problem" areas which may be corrected with "access control mechanisms" (i.e. dirt berms, special gates),

- The environmental community will be able to track, monitor and observe pre-fire and post fire areas for purposes of studying the ecological effects of fire. The location and size of unplanned fires may have an impact on any overall plans or specific schedules for controlled burns within the Central Pine Barrens.

- In the event future funds become available in the form of grants and/or reimbursement for direct fire suppression costs, it is probable the allocation of these funds would be based on the number and/or size of actual fires. Therefore, a centralized reporting system would facilitate any such process or requirement.

- This information or database would contribute to the fire protection risk and hazard assessment; thereby aiding in the request for government assistance.

8.R RECOMMENDATIONS

To accomplish the primary goal of establishing the central database of all wildfire activity within the Central Pine Barrens Core Preservation Area, several procedures need to be adopted and accepted by the fire chiefs of the affected fire districts. Therefore the following actions are recommended:

- A standard reporting format must be formalized:
  Option 1 - For departments currently reporting all fire responses to the New York State (NYS) Office of Fire Prevention in Albany, a copy of the report can be forwarded to the data collection point. The only additional information that would be needed in the "remarks" section is fire size (acreage).

  Option 2 - For departments not currently reporting all fires to the NYS Office of Fire Prevention in Albany, a sample report is provided in Appendix E.2. This format is "simpler" than the standard NYS report, requiring less than ten minutes to complete.

- The "Central Pine Barrens Fire Report" should be faxed to the NYS DEC Forest Rangers for assimilation into a standard database. It is recommended that the central database be maintained under the direction of the NYS DEC Forest Rangers in light of their related responsibilities with regard to the Central Pines Barrens area.

- To help motivate all fire departments to comply with the reporting request, we recommend that all equipment funded by the Central Pine Barrens Commission be somehow tied into periodic reporting.

- The location of wildfires is best described for reporting purposes by the use of Global Positioning System (G.P.S.) coordinates. This information would aid in the preparation of hazard risk assessments discussed under Section 5.2, Fire Assessment Planning. It is therefore recommended that G.P.S. units be provided to all districts providing fire protection to the Central Pine Barrens to facilitate the accurate location of all fires. Interim methods utilizing commercial maps or other Central Pine Barrens maps are acceptable.

- Weather data for the fire reports and possible additional fire weather analysis would be provided by the weather station at the U.S. Fish and Wildlife Wertheim Refuge. An additional weather station located within the Core Preservation Area would also be valuable. Funding for such a station may be added to the overall equipment request submitted with this fire management plan.

CHAPTER 9: FIRE MANAGEMENT AND RESPONSIBILITIES

9.1 INTRODUCTION

The purpose of this chapter is to describe the duties of various agencies and their relationships with respect to a wildfire incident on Long Island including the Central Pine Barrens region.

9.2 FIRE DEPARTMENTS AND FIRE DISTRICTS

The Central Pine Barrens region falls with the jurisdictions of 17 fire districts in Suffolk County. However, there are 18 fire departments within that area that are responsible for responding to incidents. Sixteen of those departments are volunteer departments associated with a fire district, and two are career departments with specific jurisdictional response areas. The two career departments are Brookhaven National Laboratory Fire Rescue, which protects the 5,100 acres of the laboratory and the 106th Rescue Wing Fire Department of the Air National Guard, which protects the airbase in Westhampton Beach.

Fire districts are political subdivisions governed under Article 11 Subsections 170 through 189 of the Town Law of New York State. Each district is governed by a Board of Commissioners, which is made up of five members elected by the voting public. They have sole responsibility for administration of the fire district and for ensuring the health and safety of the public. Each district ensures its duties are met by the formation and maintenance of a volunteer fire department (or, in one, case by contracting with a neighboring fire district). Additionally, many of the departments discussed here provide both fire and ambulance services to their respective communities.

When activated for response to an incident, the fire chief or his designee (usually an assistant chief) has sole responsibility for extinguishing the fire as per Article 11 Subsection 176(a) of the Town Law of New York State. It is very clear in the law that the chief of the fire department in the fire district where the incident occurs is in charge. It is not clear, however, who has prime responsibility for a fire that crosses fire district boundaries. Best management practices and utilization of the Incident Command System (ICS) suggest that a unified command structure is best for accomplishing this task. The Wildfire Task Force recommends the use of the Suffolk County Incident Command System Plan for coordinating responsibilities for a fire that crosses fire district boundaries. In order to reduce confusion at the time of an incident, pre-planning should take place and high hazard/high probability areas be reviewed to ensure smooth transition and set up of an appropriate command structure.

The fire chief is the individual responsible, as per Town Law Section 176 (a), for ensuring extinguishing a fire on town, County, and State land (i.e., public lands), beside those

owned by private entities. Best management practices and the use of ICS highly recommend meeting with the stakeholders of these lands before an incident occurs to ensure smooth transition to, and set up of, an appropriate command structure, as well as to delineate roles and responsibilities. For example, on State DEC property, the chief could incorporate the NYS DEC personnel into a unified command structure as additional resources and a direct source of knowledge specific to that site.

The fire district as per Town Law Section 170-189, has the responsibility of financially ensuring the capability of the fire department. In a fire event, the district personnel would most likely be used in the finance position of the ICS to ensure adequate record keeping and to administer the costs associated with the fire.

9.3 OUTSIDE AGENCIES

For most of the "routine" incidents associated with wildfire incidents in the Central Pine Barrens region, the town, county, state, and federal agencies will generally play a support role to the local fire departments. In fact, a great majority of the support roles will be played by town and county agencies as they are more inherently involved with the fire departments by way of County police, fire coordinators, town equipment, etc. The State, however, will play a role when their property is directly involved, or they are otherwise requested (e.g., special resources).

However, should the incident expand into the realm of the non-routine, where additional resources are required or further capabilities beyond those of the fire departments are required, then involvement by the state and/or federal level is more likely to occur. This is similar to the events which transpired in the 1995 wildfires in Suffolk County.

Just as when any other disaster takes place, the Chief Executive Officer of any municipality, be it Village Mayor, Town Supervisor, or County Executive, has the ability to declare a disaster under Article 2B of the Executive Law of New York State, within their jurisdiction. This enables resources and capabilities not normally available to the official, to be mobilized and deployed in the manner needed. It also enables other capabilities, such as mandatory evacuation by law enforcement, curfews, and enabling the state agencies to permit the use of resources without going through the formal non-emergency administrative procedures.

As the disaster escalates, the Governor activates the State Emergency Operations Center and declares a State of Emergency. The Governor contacts the Regional Federal Emergency Management Agency (FEMA) Director in New York City and requests a presidential declaration.

FEMA may activate the Regional Operations Center and coordinates with the FEMA Director in Washington DC. The FEMA Director recommends that the U.S. President declare an emergency or major disaster. The authority for this action is provided in the Robert T. Stafford Disaster Relief and Emergency Assistance Act, P.L. 93-288, as amended.

In case of a major wildfire, the USDA Forest Service is the primary federal agency that is tasked by FEMA through the Federal Response Plan umbrella. Their resources can be quickly mobilized to the disaster under the Incident Command System. Typical responding resources include Incident Management Teams, twenty person fire crews and possibly air support, as deemed appropriate by the Incident Commander.

CHAPTER 10: TRAINING

This chapter presents the recommendations of the Training Committee of the Wildfire Task Force. The Committee reviewed training requirements for firefighters that may be involved in fighting wildfires. The intent of the recommendations of this Committee is to enhance the ability of the firefighters, both structural and wildland, to better understand the different concepts and tactics of suppression, thereby providing a safer environment for the firefighter and the public.

The purpose of this chapter is to provide a list of training courses available and suggest ways of obtaining this training. It is not intended to dictate to a chief or commissioner as to what is needed in their district. What has been devised is a three (3) tier system for training:

Tier 1: Training for Firefighter Level 1
Tier 2: Train the Trainer Instruction
Tier 3: Structured Training Sessions

The first tier of training would be for Firefighter level 1 with this training designed for the beginner. The Committee agrees that "Essentials" is a lengthy course and it would not be practical to add additional time to it. The Committee suggests setting a time limit, such as by the first, second or third year, that individuals who are Firefighter level 1 receive a course in basic Incident Command System (ICS), as approved by Suffolk County FRES (described by the National Fire Academy) or the ICS that is approved by the National Wildfire Coordinating Group (NWCG). It is recommended, that this group and the Wildfire Task Force bring their individual ICS Plans together to show solidarity. Another course for the beginner should address the safety aspect of wildland fire suppression. This course could be taken out of the Standards for Survival Course of the NWCG or be developed by the Suffolk County Training Academy.

The second tier of training would focus on train the trainer type of instruction. The Committee recognizes that there are many experienced senior firefighters, ex-chiefs, current chiefs and line officers that do an exceptional job every time they respond to a wildfire. Some of these individuals, however, may not be the "in house instructors" for training new members or refreshing the two to five year members. Therefore the Committee makes the following recommendations for this training.

The train the trainer participant should be someone in the individual fire department who would take a handoff course, bring the information back to his/her department and train or jointly train that particular department. Some of the courses that could be adapted for this type of instruction would be brush truck operations in a wildfire setting, HAZMAT

awareness, communications, protocol and discipline, wildfire safety courses, wildland-urban interface survival course, which is also a good public education course, instruction on interruptive forms/reports and review of the Unified Command System.

The last or third tier of training would provide structured training sessions given by qualified instructors from Suffolk County Fire Academy, or the NYS Forest Rangers and/or representatives from the National Wildfire Coordinating Groups (NWCG). A list of available wildfire firefighter training courses is provided in Appendix F.

An additional suggested training topic would cover fire prevention. This would be in conjunction with the P-101 course, which is Introduction to Wildfire Protection, but it would be targeted to the public. The first course would be Urban Interface Survival, which is six hours long and could also be a train the trainer fire department course. This particular course would be given to the general public to inform them on how to protect themselves during fire emergencies. The next would be a quick public awareness course dealing with fire danger ratings, fire indexes and the like, that would be one to two hours.

To compliment this prevention course is the course P-110 Inspecting Fire Prone Property (two hours), this would work to the advantage of the Code Enforcement people, the Fire Marshals and Fire Chiefs. Then finally, there is a need to have an education program on prescribed fire, for the public and for the fire service personnel. NWCG is working on such a project, but it is not yet completed.

The Committee feels that the use of an Incident Command System (ICS) is both essential to the proper management for any emergency and paramount in providing for firefighter safety. Therefore, the Committee recommends that all departments utilize an ICS and that the Suffolk County Fire Academy ICS course be completed by all line and chief officers of the individual departments.

10.R RECOMMENDATIONS

- It is imperative that all fire suppression personnel know and understand the Incident Command System (ICS) and where they fit in. Continue training in ICS.

CHAPTER 11: PRESCRIBED FIRE PROGRAM

11.1 PRESCRIBED FIRES

Prescribed fires (also called controlled fires) are fires intentionally ignited by specifically trained fire professionals to accomplish management objectives in specific areas under defined conditions identified in an approved prescribed fire plan. Unlike wildfires, prescribed fires are conducted only when conditions are acceptable.[1]

Strategically placed prescribed fires offer the opportunity to reduce the threat of uncontrollable wildfires and increase firefighter safety. When a wildfire burns in a recently burned area the rate of spread is slower, the fire intensity is lessened, the access through the vegetation is easier and over-all there is a greater degree of safety for the firefighter. This is because the volume of dead needles, leaves and branches is reduced when an area is regularly burned. This process is called fuel load reduction.

There may also be ecological benefits to prescribed fire. It is commonly believed that the Central Pine Barrens is a mosaic of fire-maintained natural communities and supports many species, including scrub oak, that could be favored by periodic fire. Wildlife that feed on resprouting vegetation following a fire and that prefer open sunny habitat profit from fires as well. With effective planning, a prescribed fire management program can benefit the Central Pine Barrens fire suppression program as well as meet ecological goals.

Smoke emissions from prescribed fire are generally less than wildfires, because prescribed fires are set under conditions which are amenable to more efficient combustion and less smoldering. This has been demonstrated through various prescribed burns.

11.2 PRESCRIBED FIRE STANDARDS

All prescribed fires will comply with Articles 9-1105 of NYS Environmental Conservation Law, the Central Pine Barrens Land Use Plan and all applicable local regulations and standards.

All prescribed fires will:

a. Have a prescribed burn unit plan for each burn.
b. Be conducted by certified prescribed burn boss and qualified crew.
c. Secure open burning permits from NYS DEC.

[1] Note prescribed burns can generally be performed only during a very limited or specific time frame since the conditions are very stringent.

d. Secure permit from the town Fire Marshal.
e. Secure concurrence from the local district Fire Chief.
f. Notify local emergency officials.
g. Advise local residents who live within 0.5 miles of the burn unit.
h. Prepare a general press release to inform the public of proposed burns.

11.3 COMPREHENSIVE PRESCRIBED FIRE MANAGEMENT PLAN

Before a prescribed burn program is implemented, a comprehensive prescribed fire management plan must be prepared. The comprehensive prescribed fire management plan will present ecological and land management objectives, justify these objectives, consider alternatives to burning, identify priority areas and annual acreage goals, describe the research and monitoring, analyze the weather patterns, present fuel models, and discuss fuel reduction, wildfire policies, smoke management, safety issues and legal considerations.

Upon completion, the plan is subject to review under the State Environmental Quality Review Act (Article 8 of the New York State Environmental Conservation Law) and will be distributed to interested parties, including but not limited to fire departments. Public meetings will be held to present and discuss the plan.

11.4 PRESCRIBED FIRE IMPLEMENTATION

a. Prescribed burning may have three objectives: management burns (fuel reduction), training and demonstration, and research for ecological responses. An individual prescribed burn may be a combination of types with multiple objectives.

b. Safety is of paramount importance to the prescribed fire program. Each prescribed burn is carried out only under specified conditions of wind speed, wind direction, temperature and humidity (prescribed unit burn plan). Such burns are carefully planned with firebreaks established ahead of time.

c. An interagency program will be developed to train additional crew members, coordinate fire management activities, and cooperate in the planning and implementation of the prescribed burns. At present the NYS Department of Environmental Conservation, the US Fish and Wildlife Service, Suffolk County Parks, and The Nature Conservancy have staff trained to conduct prescribed fire management in the Central Pine Barrens.

Volunteer fire departments are not expected to implement the prescribed fire management program or to provide personnel and equipment. However, fire

departments will have the option to participate in the planning, training, and implementation.

e. If a prescribed burn exceeds a predefined size or area, as detailed in the unit burn plan, then it is considered out of prescription. The local fire department will immediately be called and the local fire chief will assume command and authority for the suppression. Any on scene personnel will fall under the fire chief's jurisdiction.

f. The prescribed fire management program in the Central Pine Barrens will begin slowly and carefully with ample time for careful analysis of all issues. The first burns will be small with a low level of complexity. The prescribed burn program can only grow as the "comfort level" grows.

The site locations and amount of acreage will be determined in the course of preparing the comprehensive prescribed fire management plan. Burn units will be selected according to the strategic goals set by the Wildfire Task Force and/or individual fire departments in conjunction with landowning agencies as well as ecological goals determined by landowning agencies. Properties owned by New York State, Suffolk County, and The Nature Conservancy will be initial priority sites.

11.5 PRESCRIBED FIRE STAFFING QUALIFICATIONS

All prescribed burns are conducted by a trained and qualified crew supervised by a prescribed fire leader who has specialized training and experience in fire management. As an individual gains higher levels of training in both suppression and prescribed fire management and gains more experience, he/she is able to assume higher levels of responsibility in the crew organization.

11.6 MONITORING AND EVALUATION

Monitoring and evaluation of the prescribed fire management program is a necessary component of the prescribed fire management program. Effective monitoring provides the basis for objective evaluation and tracking of the program, and as necessary, modification of management practices to ensure that the goals are being achieved. Both ecological effects and fuel load reduction will be examined.

11.7 SMOKE MANAGEMENT GUIDELINES

Smoke management is a serious concern when using prescribed fire as a management tool. Not only is public health a concern, but the potential public nuisance and hazard due to visibility impairment of residential areas and highways is also an issue. Emissions from prescribed burns are a regulatory concern due to air quality standards. Suffolk County is designated as an ozone non-attainment area due to its proximity to New York City.

All prescribed fire planning will take smoke management into account. Prescribed burning will only be conducted when the atmosphere is slightly unstable to allow for maximum lift of the smoke column. Prescriptions will include practices that reduce or control the amount of smoke and direct it away from smoke sensitive areas. Ignition pattern, timing of burns, location of unit, size of unit, and wind direction are variables that can be utilized to minimize smoke hazards.

Every prescribed burn will have smoke spotters with radios who will report on the direction and density of smoke throughout the ignition period. If smoke does not meet the requirements of the prescription, the burn will be shut down immediately.

11.8 PUBLIC AWARENESS

Public awareness about the role of prescribed burning in managing the Central Pine Barrens will be developed through general education and outreach programs. Residents that live in the vicinity of burn units will receive advance notification and opportunity to comment and if desired, notification of the prescribed burns on the day of the burn.

11.R RECOMMENDATIONS

- Develop a Comprehensive Prescribed Fire Management Plan for the Central Pine Barrens in conjunction with the Protected Lands Council.

- Utilize prescribed fire to reduce standing dead fuel in strategic locations to increase public and firefighter safety and aid suppression efforts.

- Develop an ecological research prescribed fire management program. To maintain a shifting mosaic of natural Central Pine Barrens communities and favor rare and characteristic species of the Central Pine Barrens.

- Develop interagency fire agreements to implement the prescribed fire management program.

- Provide planning, education and training, and implementation opportunities for volunteer firefighters.

- Incorporate education about prescribed fire into education and outreach programs conducted by fire departments, agencies and organizations.

APPENDIX A:
GLOSSARY

[The definitions for terms that appear in italics in this glossary were obtained from the *Glossary of Wildland Fire Terminology* (NFES 1832), National Wildfire Coordinating Group, 1996].

GLOSSARY

accountability tags:
Identification cards that are collected at an incident and returned at conclusion to ensure no one is left behind.

aerial fuels:
Standing and supported live and dead combustibles not in direct contact with the ground and consisting mainly of foliage, twigs, branches, stems, cones, bark, and vines.

aggregation:
A term used in fire protection assessment planning that refers to the combining of information gathered for an area concerning hazards, risks and values related to fire potential, which is then used to develop fire management units.

allowable burned area:
Maximum average area burned over a specified period of years that is considered an acceptable loss for a specified area under organized fire suppression.

anchor point:
An advantageous location, usually a barrier to fire spread from which to start constructing a fireline. Used to minimize the chance of being flanked by the fire while the line is being constructed.

available fuel:
The portion of the total fuel that actually burns under various environmental conditions.

backburn:
Used in some localities to specify a fire set to spread against the wind in prescribed burning.

backfire:
A tactic associated with indirect attack, intentionally setting fire to fuels inside the control line to slow, knock down, or contain a rapidly spreading fire. Backfire provides a wide defense perimeter and may be further employed to change the force of the convection column. Backing fire makes possible a strategy of locating control lines at places where the fire can be fought on the firefighter's terms. Except for rare circumstance meeting specified criteria, backing fire is executed on a command decision made through line channels of authority.

bambi bucket:
A collapsible bucket slung below a helicopter. Used to dip water from a variety of sources for fire suppression.

barrier:
Any obstruction to the spread of fire. Typically, an area or strip devoid of flammable fuel.

berm:
Ridge of soil or debris that is along, outside, or on the downhill side of a ditch or trench, resulting from line construction.

blowup:
Sudden increase in fire intensity or rate of spread sufficient to preclude direct control or to upset existing control plans. Often accompanied by violent convection and may have other characteristics of a fire storm.

brand patrol: (Local terminology)
Person or persons assigned to look for and extinguish spot fires.

breakover:
A fire edge that crosses a control line or natural barrier intended to confine the fire. The resultant fire. Also called slopover.

broadcast burning:
Intentional burning in which fire is intended to spread over all of a specific area within well defined boundaries.

brush:
A collective term that refers to stands of vegetation dominated by shrubby, woody plants, or low growing trees, usually of a type undesirable for livestock or timber management.

brush fire:
Local terminology for wildfire. See wildfire.

brush truck:
An all wheel drive protectively armored engine with pump and roll capability which is able to maneuver through various wildland fuels in a direct attack fire suppression mode.

build-up:
1. Cumulative effects of drying (during a preceding period) on the current fire danger.
2. Acceleration of a fire with time.
3. Increase in strength of a fire management organization.

burning conditions:
The state of the combined factors of environment that affect fire behavior in a specific fuel type.

burning index:
An estimate of the potential difficulty of fire containment as it relates to the flame length at the head of the fire. A relative number related to the contribution that fire behavior makes to the amount or effort needed to contain a fire in a particular fuel type within a rating area.

burning-index meter:
A device used to determine burning index for different combinations of burning index factors.

burning period:
That part of each 24 hour period when fires will spread most rapidly. Typically, this is from 10 a.m. to sundown.

burn out:
Setting fire inside a control line to consume fuel between the edge of the fire and the control line.

Central Pine Barrens:
A statutorily defined 100,000 acre, geographic area as per New York State Environmental Conservation Law Section 57-107.10, that is located within the central and eastern portions of Suffolk County in New York. This area includes parts of the Towns of Brookhaven, Riverhead and Southampton and is divided into two

regions: an approximaely 52,500 acre Core Preservation Area and an approximately 47,500 acre Compatible Growth Area that surrounds the core area. A comprehensive land use management plan was prepared in 1995 that regulates development in this area in order to preserve and protect its ecological and hydrological resources.

check line:
A temporary line constructed at right angles to the control line, and used to hold a backing fire in check as a means of regulating the heat (or intensity) of the backfire.

class of fire (as to kind of fire for purpose of using proper extinguisher):
Class A: Fire in solid fuels, including forest fires.
Class B: Fire in flammable liquids.
Class C: Fire in electrical equipment.
Class D: Fire involving certain combustible metals.

closed area:
An area in which specified activities or entry are temporarily restricted to reduce risk of person-caused fires.

cold trailing:
A method of controlling a partly dead fire edge by carefully inspecting and feeling with the hand to detect any fire, digging out every live spot, and trenching any live edge.

command post:
The location from which all fire operations are directed. There is normally only one command post for each fire situation.

command staff:
The command staff consists of the information officer, safety officer, and liaison officer. They report directly to the incident commander and may have an assistant or assistants, as needed.

Compatible Growth Area:
The area within the Central Pine Barrens, but outside of the core preservation area as defined in New York State Environmental Conservation Law Section 57-0107.12.

condition of vegetation:
Stage of growth, or degree of flammability, of vegetation that forms part of a fuel complex. Herbaceous stage is at times used when referring to herbaceous vegetation alone. In grass areas minimum qualitative distinctions for stages of annual growth are usually green, curing, and dry or cured.

confine a fire:
The least aggressive wildfire suppression strategy, typically allowing the wildland fire to burn itself out within restrict determined natural or existing boundaries such as rocky ridges, streams and possibly roads.

contain a fire:
A moderate aggressive suppression strategy, which can reasonably be expected to keep the fire within established boundaries of constructed firelines under prevailing conditions.

control a fire:
To complete a control line around a fire, any spot fires therefrom, and any interior islands to be saved; burnout any unburned area adjacent to the fire side of the control lines; and cool down all hotspots that are immediate threats to the control line, until the lines can reasonably be expected to hold under foreseeable conditions.

control force:
Personnel and equipment used to control a fire.

control line:
An inclusive term for all constructed or natural fire barriers and treated fire edge used to control a fire.

Core Preservation Area:
The area of the Central Pine Barrens that comprises the largest intact areas of undeveloped pine barrens as defined in New York State Environmental Conservation Law Section 57-0107.11.

crew boss:
A person in supervisory charge of usually 16 to 21 firefighters and responsible for their performance, safety, and welfare.

crown fire:
A fire that advances from top to top of trees or shrubs more or less independently of the surface fire. Sometimes crown fires are classed as either running or dependent, to distinguish the degree of independence from the surface fire.

defensible space:
Refers to distances from exposures to wildfire hazards in relation to the ability to safely protect those exposures.

detection:
The act or system of discovering and locating fires.

direct-aggressive:
Local terminology used to describe initial suppression activity where equipment is working on the head of the fire.

direct attack:
Any treatment applied directly to burning fuel, e.g., by wetting, smothering, or chemically quenching the fire or by physically separating the burning from unburned fuel.

direct-flank:
Local terminology to describe initial suppression activity where equipment is working on the sides of the fire where intensity is lower.

discovery:
Determination that a fire exists. In contrast to detection, location of a fire is not required.

dispatcher:
A person who receives reports of discovery and status of fires, confirms their location, takes action promptly to provide people and equipment likely to be needed for control efforts.

division:
A unit established to divide an incident into geographical areas of operation.

drought index:
A number representing net effect of evapotranspiration and precipitation in producing cumulative moisture-depletion in deep duff or upper soil layers.

duff:
The partly decomposed organic material of the forest floor beneath the litter of freshly fallen twigs, needles, and leaves.

elapsed time:
Total time taken to complete any given step(s) in fire suppression.

entrapment:
A situation where personnel are unexpectedly caught in a fire behavior-related, life-threatening position where planned escape routes or safety zones are absent, inadequate, or compromised. An entrapment may or may not include deployment of a fire shelter for its intended purpose. These situations may or may not result in injury. They include "near misses."

equipment use fire:
Fire caused by mechanical equipment other than railroad operations.

escape route:
A pre-planned and understood route firefighters take to move to a safety zone or other low-risk area. When escape routes deviate from a defined physical path, they should be clearly marked (flagged).

escaped fire:
A fire which has exceeded or expected to exceed initial attack capabilities or prescripition.

Escaped Fire Situation Analysis (EFSA):
A decision analysis that uses factors that influence suppression of an escaped fire from which a plan of action will be developed. The analysis includes the development of alternative suppression strategies and the probable cost and damages associated with each.

exposure:
1. Property that may be endangered by a fire burning in another structure or by a wildfire.
2. Direction in which a slope faces, usually with respect to cardinal directions.
3. The general surroundings of a site with special reference to its openness to winds.

exposure fire:
Classification for a fire not originating in a building, but which ignites building(s). A fire originating in one building and spreading to another is classified under the original cause of fire.

extended attack incident:
A wildland fire that has not been contained or controlled by initial attack forces and for which more firefighting resources are arriving, en route, or being ordered by the initial attack incident commander.

Extended attack implies that the complexity level of the incident will increase beyond the capabilities of initial attack incident command.

fine fuel moisture:
The probable moisture content of fast-drying fuels which have a time lag constant of one hour or less; such as, grass, leaves, ferns, tree moss, draped pine needles, and small twigs (0-1/4").

fire analysis:
Process of reviewing the fire control action on a given unit or the specific action taken on a given fire in order to identify reasons for both good and poor results, and to recommend or prescribe ways and means of doing a more effective and efficient job.

fire behavior:
The manner in which a fire reacts to the variables of fuel, weather, and topography.

firebreak:
A natural or constructed barrier used to stop or check fires that may occur or to provide a control line from which to work.

fire chief:
Individual elected by the members of the fire department of the fire district whose duties are defined under the Consolidated Laws of New York Annotated Town Law, Chapter 62, Article 11-- Fire, Fire Alarm and Fire Protection Districts, Section 176-a. The chief under the direction of the board of fire commissioners has exclusive control of the members of the fire department of the fire district at all fires, inspections, reviews and other occasions when the fire department is on duty or parade. He also has supervision of engines, fire trucks, and other firefighting apparatus and property used for the prevention or extinguishment of fire and of all officers and employees of the fire department and ensures the rules and regulations of the board of commissioners are observed and duly executed.

fire classification:
Numerical category 1 to 7 that indicates the severity of a fire with 1 representing the lightest and 7 representing a conflagration of 5,000 acres or more.

fire commissioners:
Individuals appointed by the town board, to serve on a board of fire commissioners that is comprised of five fire district commissioners and a treasurer that serve without compensation, except for the secretary whom may be compensated. According to Consolidated Laws of New York Annotated Town Law, Chapter 62, Article 11-- Fire, Fire Alarm and Fire Protection Districts, Section 176, the board has the authority to organize, operate, maintain and equip fire companies and may adopt rules and regulations governing all fire companies and fire departments in said district and prescribe the duties of the members. Such rules and regulations shall not interfere with the duties of the chief or assistant chief at such times as the fire department or any company or squad thereof is on duty.

fire control:
All activities to protect wildland from fire. (Includes prevention, pre-suppression, and suppression.)

fire control equipment:
All tools, machinery, special devices, and vehicles used in fire control, but excluding structures.

fire damage:
Detrimental fire effects expressed in monetary or other units including the unfavorable effects of fire changes in the resource base on the attainment of organizational goals.

fire danger:
Sum of constant danger and variable danger factors, affecting the inception, spread, and resistance to control, and subsequent fire damage, often expressed as an index.

Fire Danger Rating System:
A system used to estimate the potential for forest fires based on weather factors and vegetation condition.

fire danger station:
A specific location where certain basic weather elements affecting fire are measured.

fire department:
An organization for preventing or extinguishing fires.

fire district:
As defined in Consolidated Laws of New York Annotated Town Law, Chapter 62, Article 11-- Fire, Fire Alarm and Fire Protection Districts, Section 174.7, a fire district is a political subdivision of the state and a district corporation within the meaning of section three of the general corporation law. The officers and employees of a fire district, including the paid and volunteer members of the fire department are officers and employees of such fire district and are not officers or employees of any other political subdivision.

fire effects:
The physical, biological, and ecological impact of fire on the environment.

firefighter:
Person whose principal function is fire suppression.

fireline:
The part of a control line that is scraped or dug to mineral soil. Also called fire trail.

fire management:
Activities required for the protection of burnable woodland values from fire, and the use of prescribed fire to meet land management goals and objectives.

fire management analysis zone (FMAZ):
The basic geographical (analysis) area represented by a single set of fire behavior characteristics based on fuels, topography, and local weather.

Fire Protection Assessment (FPA) planning:
A tool used by fire managers, resource managers and other stakeholders to make quality resource management decisions concerning fire management for a specific area. It involves identifying the hazards, risks, values as they relate to fire potential, which are used to develop fire management zones. The final product of a fire protection assessment is a fire management action plan that identifies fire suppression tactics and strategies, fire prevention actions, and fuel management priorities needed for this area.

fire protection district:
A fire district that contracts with a fire district, fire department or fire company outside of that district for fire protection services.

fire resistive:
Material that is covered in a substance that increases its ignition point, thereby reducing the probability of burning.

fire scar:
1. A healing or healed injury or wound to woody vegetation, caused or accentuated by a fire.
2. The mark left on a landscape by fire.

fire season:
The period or periods of the year during which fires are likely to occur, spread, and do sufficient damage to warrant organized fire control.

fire storm:
Violent convection caused by a large continuous area of intense fire. Often characterized by destructively violent surface indrafts near and beyond the perimeter, and sometimes by tornado-like whirls.

fire weather forecast:
A weather prediction specially prepared for use in wildland fire operations and prescribed fire.

fire weather index:
A numerical rating based on meteorological measurement of fire intensity in a standard fuel. Fire weather index is comprised of three fuel moisture codes, covering classes of forest fuels of different drying rates and two indices that represent rate of spread and amount of available fuel.

fire weather station:
A forest meteorological station specially equipped to measure weather elements that have an important effect on fire behavior.

flammability:
The relative ease with which fuels ignite and burn regardless of the quantity of the fuels. Preferred to "inflammability."

flanking fire suppression:
Attacking a fire by working along the flanks either simultaneously or successively from a less active or anchor point and endeavoring to connect the two lines at the head.

flare-up:
Any sudden acceleration of fire spread or intensification of the fire. Unlike blowup, a flare-up is of relatively short duration and does not radically change existing control plans.

flash fuels:
Fuels such as grass, leaves, draped pine needles, fern, tree moss, and some kinds of slash which ignite readily and are consumed rapidly when dry.

foam:
A chemical fire extinguishing mixture. When applied it forms bubbles which greatly increase the mixture volume. It adheres to the fuel, and reduces combustion by cooling and moistening and by excluding oxygen.

forest fire:
A wildland fire not prescribed for the area by an authorized plan.

fuelbreak:
A natural or manmade change in fuel characteristics which affects fire behavior so that fires burning into them can be more readily controlled.

fuel characteristics:
Factors that make up fuels such as compactness, loading, horizontal continuity, vertical arrangement, chemical content, size and shape, and moisture content.

fuel ladders:
Fuels above ground and their vertical continuity, which influences fire reaching various levels or vegetation strata. (Also called vertical fuel arrangement).

fuel models:
Mathematical models that have been developed to quantitatively rate fire danger and predict fire behavior. The models require descriptions of fuel properties as inputs to calculations of fire danger indices of fire behavior potential. The collections of fuel properties have become known as fuel models.

fuel moisture content:
The quantity of moisture in fuel expressed as a percentage of the weight when thoroughly dried at 212° F.

fuel-moisture indicator stick:
A specially prepared stick or set of sticks of known dry weight continuously exposed to the weather and periodically weighed to determine changes in moisture content as an indication of moisture changes in wildland fuels.

fuel reduction:
Manipulation, including combustion, or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control.

fuel type:
An identifiable association of fuel elements of distinctive species, form, size, arrangement, or other characteristics that will cause a predictable rate of spread or resistance of control under specified weather conditions.

global positioning system:
A satellite navigation system used for military and civilian applications, funded and controlled by the U.S. Department of Defense, that is used for navigation in three dimensions, precise positioning, time and frequency dissemination and other research.

ground fire:
Fire that consumes the organic material beneath the surface litter of the forest floor, such as, peat fire.

hand crews:
Personnel assigned to a given fire that use hand tools to suppress or mop-up the fire with fire lines.

hazard:
A fuel complex defined by kind, arrangement, volume, condition, and location that forms a special threat of ignition and resistance to control.

hazard reduction:
Any treatment of living and dead fuels that reduces the threat of ignition and spread of fire.

hazards:
As used in fire protection assessment planning, they are management units based on the physical or biological features resulting in similar fire behavior characteristics that are ranked as high, moderate or low depending on their potential for extreme fire behavior and their resistance to control.

head fire:
A fire spreading or set to spread with the wind.

head of fire:
The most rapidly spreading portion of a fire's perimeter, usually to the leeward or up slope.

heavy fuels:
Fuels of large diameter such as snags, logs, and large limbwood, which ignite and are consumed more slowly than flash fuels. Also called coarse fuels.

held line:
All control line that still contains the fire when mopup is completed. Excludes lost line, natural barriers not backfired, and unused secondary lines.

high band VHF:
Radio with higher brackets of very high band frequencies of 145 to 170 megahertz.

holdover fire:
A fire that remains dormant for a considerable time. Also called sleeper fire.

hotshot crew:
Intensively trained fire crew used primarily in hand line construction (Type 1).

hotspot:
A particularly active part of a fire.

hourly fuels:
A way of defining the drying factor of various fuels (i.e., 10 hour fuels are 1/4 to 1 inch in thickness and take 10 hours to change their moisture content or dry out).

incendiary fire:
A wildfire willfully ignited by anyone to burn, or spread to, vegetation or property without consent of the owner or his agent.

Incident Action Plan (IAP):
Contains objectives reflecting the overall incident strategy and specific tactical actions and supporting information for the next operational period. The plan may be oral or written. When written, the plan may have a number of attachments, including: incident objectives, organization assignment list, division assignment, incident radio communication plan, medical plan, traffic plan, safety plan,, and incident map. Formerly called shift plan.

Incident Commander (IC):
The individual responsible for the management of all incident (fire) operations at the incident site.

Incident Command System (ICS):
A standardized on-scene emergency management concept specifically designed to allow its user(s) to adopt an integrated organizational structure equal to the complexity and demands of single or multiple incidents, without being hindered by jurisdictional boundaries.

indirect attack:
A method of suppression in which the control line is located some considerable distance away from the fire's active edge. Generally done in the case of a fast-spreading or high intensity fire and to utilize natural or constructed firebreaks or fuelbreaks and favorable breaks in the topography. The intervening fuel is usually backfired; but occasionally the main fire is allowed to burn to the line, depending on conditions.

indirect-defensive:
Local terminology defining how the resources are deployed in extreme fire conditions using natural or manmade firebreaks.

initial attack:
The actions taken by the first resources to arrive at a wildfire to protect lives and property, and prevent further extension of the fire.

Keetch-Byram Drought Index:
Commonly-used drought index adapted for fire management applications, with a numerical range from 0 (no moisture deficiency) to 800 (maximum drought).

latitude:
Angular distance, in degrees, minutes and seconds of a point north or south of the equator.

lead plane:
Aircraft with pilot used to make trial runs over the target area to check wind, smoke conditions, topography and to lead air tankers to targets and supervise their drops.

leapfrog method:
A system of organizing workers in fire suppression in which each crew member is assigned a specific task such as clearing or digging fireline on a specific section of the control line, and when that task is completed, passes other workers in moving to a new assignment.

liaison officer:
A member of the command staff responsible for coordinating with agency representatives from assisting and cooperating agencies.

line firing techniques:
Methods and tactics used to set fire along firelines or firebreaks, in wildland fire suppression or pre-suppression to get a desired effect.

litter:
The top layer of the forest floor, composed of loose debris of dead sticks, branches, twigs, and recently fallen leaves or needles, little altered in structure by decomposition.

live fuel moisture content:
Ratio of the amount of water to the amount of dry plant material in living plants.

logistics section:
The section responsible for providing facilities, services and materials for the incident.

longitude:
Angular distance, in degrees, minutes and seconds of a point east or west of the Greenwich meridian.

low band VHF:
Radio with lower brackets of very high band frequencies of 30 to 50 megahertz.

mini-engine:
Fire apparatus that has less than 500 gallons of water with pump capabilities of less than 750 gallons per minute.

Minimum Impact Suppression Techniques (MIST):
The application of strategy and tactics that effectively meet suppression and resource objectives with the least environmental, cultural and social impacts.

mop-up:
Extinguishing or removing burning material near control lines, felling snags, and trenching logs to prevent rolling after an area has burned, to make a fire safe, or to reduce residual smoke.

mutual aid:
Assistance rendered by other than originating organization.

National Fire Danger Rating System:
A uniform fire danger rating system that focuses on the environmental factors that control the moisture content of fuels.

natural barrier:
Any area where lack of flammable material obstructs the spread of wildfires.

neighborhood watch:
Group of citizens living in the same area who join together to protect one another through routine observation of the area where they live for criminal activity.

Nomex:
Trade name for a fire resistant synthetic material used in the manufacturing of flight suits and pants and shirts used by firefighters. Aramid is the generic name.

non-attainment area:
An area identified by an air quality regulatory agency through ambient air monitoring (and designated by the Environmental Protection Agency), that presently exceeds federal ambient air standards.

normal fire season
1. A season when weather, fire danger, and number and distribution of fires are about average.
2. Period of the year that normally comprises the fire season.

operations section:
The section responsible for all tactical operations at the incident. Includes branches, divisions and/or groups, task forces, strike teams, single resources and staging areas.

paracargo:
Anything intentionally dropped or intended for dropping from any aircraft by parachute, by other retarding devices, or by free fall.

parallel attack:
Method of fire suppression in which fireline is constructed approximately parallel to, and just far enough from the fire edge to enable workers and equipment to work effectively, though the fireline may be shortened by cutting across unburned fingers. The intervening strip of unburned fuel is normally burned out as the control line proceeds but may be allowed to burnout unassisted where this occurs without undue delay or threat to the fireline.

patrol:
1. To travel over a given route to prevent, detect, and suppress fires.
2. To go back and forth vigilantly over a length of control line during or after its construction, to prevent breakovers, control spot fires, or extinguish overlooked hot spots.
3. A person or group who carry out patrol actions.

payments in lieu of taxes (PILOT)
Method of compensating taxing districts for tax revenue lost from land taken off the tax rolls.

planning section:
Responsible for all collection, evaluation, and dissemination of tactical information related to the incident, and for the preparation and documentation of incident action plans. The section also maintains information on the current and forecasted situation, and on the status of resources assigned to the incident. Includes the situation, resource, documentation, and demobilization units, as well as technical specialists.

preparedness:
1. Condition or degree of being ready to cope with a potential fire situation.
2. Mental readiness to recognize changes in fire danger and act promptly when action is appropriate.

prescribed burning:
Controlled application of fire to wildland fuels in either their natural or modified state, under specified environmental conditions, which allow the fire to be confined to a pre-determined area, and produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives.

prescription:
A written statement defining the objectives to be attained as well as the conditions of temperature, humidity, wind direction and speed, fuel moisture, and soil moisture, under which a fire will be allowed to burn. A prescription is generally expressed as acceptable ranges of the prescription elements, and the limit of the geographic area to be covered.

pre-suppression:
Activities in advance of fire occurrence to insure effective suppression action. Includes recruiting and training, planning the organization, maintaining fire equipment and fire control improvements, and procuring equipment and supplies. See Prevention, Suppression.

prevention:
Activities directed at reducing the incidences of fires that start, including public education, law enforcement, personal contact, and reduction of fuel hazards.

progressive hose-lay:
A hose-lay in which double shutoff wye (Y) valves are inserted in the main line at intervals and lateral lines are run from the wyes to the fire edge, thus permitting continuous application of water during extension of the lay.

progressive method of line construction:
A system of organizing workers to build fireline in which they advance without changing relative positions in line. There are two principal methods of applying the system:
1. Work is begun with a suitable space, such as 15 feet, between people. Whenever one crew member overtakes another, all of those ahead move one space forward and resume work on the uncompleted part of the line. The last person does not move ahead until the work is complete in assigned space. Forward progress of the crew is coordinated by a crew leader. This method or organization is variously termed moveup, stepup, bumpup, and functional.
2. Each person does one to several licks or strokes of work and moves forward a specified distance. The distance is determined by the number of people equipped with a given tool and number of licks needed per unit of line to complete the work for that tool. This method is termed one-lick.

project fire:
Usually refers to a fire requiring people and equipment beyond the resources of the protection unit on which it originates.

proportioner:
A device that adds a pre-determined amount of foam concentrate to water to form foam solution.

protection boundary:
The exterior perimeter of an area within which a specified fire agency has assumed a degree of responsibility for wildland fire control. It may include land in addition to that for which the agency has jurisdictional or contractual responsibility.

rate of spread:
The relative activity of a fire in extending its horizontal dimensions. It is expressed as rate of increase of the total perimeter of the fire, as rate of forward spread of the fire front, or as rate of increase in area, depending on the intended use of the information. Usually it is expressed in chains per hour or acres per hour for a specific period in the fire's history.

rear of a fire:
1. That portion of a fire spreading directly into the wind or down slope.
2. That portion of a fire edge opposite the head.
3. Slowest spreading portion of a fire edge. Also called heel of a fire.

reburn:
1. Repeat burning of an area over which a fire has previously passed, but left fuel that later ignites when burning conditions are more favorable.
2. An area that has reburned.

relative humidity:
The ratio of the amount of moisture in the air, to the maximum amount of moisture that air would contain if it were saturated. The ratio of the actual vapor pressure to the saturated vapor pressure.

risk:
1. The chance of fire starting as determined by the presence and activity of causative agents.
2. A causative agent.
3. (NFDRS) A number related to the potential number of firebrands to which a given area will be exposed during the rating day.

risks:
As used in fire protection assessment planning, the potential of natural or accidental ignition to occur within a fire management landscape. Risk is determined based on land use patterns and is categorized as high, moderate or low.

rough:
The accumulation of living and dead ground and under story vegetation, especially grasses, forest litter, and draped dead needles, sometimes with addition of underbrush, such as palmetto, gallberry, and waxmyrtle. Most often used for southern pine types.

running fire:
Behavior of a fire spreading rapidly with a well-defined head.

safety island:
An area used for escape in the event the line is outflanked or in case a spot fire causes fuels outside the control line to render the line unsafe. In firing operations, crews progress so as to maintain a safety island close at hand, allowing the fuels inside the control line to be consumed before going ahead.

safety zone:
An area cleared of flammable materials used for escape in the event the line is outflanked or in case a spot fire causes fuels outside the control line to render the line unsafe. In firing operations, crews progress so as to maintain a safety zone close at hand allowing the fuels inside the control line to be consumed before going ahead. Safety zones may also be constructed as integral parts of fuelbreaks; they are greatly enlarged areas which can be used with relative safety by firefighters and their equipment in the event of blowup in the vicinity.

scorch height:
Average heights of foliage browning or bole blackening caused by a fire.

scratch line:
An unfinished preliminary control line hastily established or constructed as an emergency measure to check the spread of a fire.

secondary line:
Any fireline constructed at a distance from the fire perimeter concurrently with or after a line already constructed on or near to the perimeter of the fire. Generally constructed as an insurance measure in case fire escapes control by the primary line.

size class of fire (as to size of wildland fires)
Class A: A fire of one-fourth acre or less.
Class B: A fire of more than one-fourth acre, but less than 10 acres.
Class C: A fire of 10 acres or more, but less than 100 acres.
Class D: A fire of 100 acres or more, but less than 300 acres.
Class E: A fire of 300 acres or more, but less than 1000 acres.
Class F: A fire of 1000 acres or more, but less than 5000 acres.
Class G: A fire of 5000 acres or more.

size-up:
The evaluation of the fire to determine the course of action for suppression.

smoldering:
Behavior of a fire burning without flame and barely spreading.

snag:
A standing dead tree or part of a dead tree from which at least the leaves and smaller branches have fallen. Often called stub, if less than 20 feet tall.

span of control:
The supervisory ratio of from three-to-seven individuals, with five-to-one being established as optimum.

spot burning:
A modified form of broadcast slash burning in which only the greater accumulations are fired and the fire is confined to these spots. Sometimes called "Jackpot Burning".

spot fire:
Fire ignited outside the perimeter of the main fire by flying sparks or embers.

spotting:
Behavior of a fire producing sparks or embers that are carried by the wind and which start new fires beyond the zone of direct ignition by the main fire.

spread component:
Part of the National Fire Danger Rating System (NFDRS). A rating of the forward rate of spread of a head fire.

staging area:
Locations set up at an incident where resources can be placed while awaiting a tactical assignment on a three (3) minute available basis. Staging Areas are managed by the Operations Section.

standby crew:
A group of trained firefighters stationed at a dispatch point for quick, rapid deployment.

strike team:
Specified combinations of the same kind and type of resources, with common communications, and a leader.

strip burning:
1. Burning by means of strip firing.
2. In hazard reduction, burning narrow strips of fuel and leaving the rest of the area untreated by fire.

strip firing:
Setting fire to more than one strip of fuel and providing for the strips to burn together. Frequently done in burning out against a wind where inner strips are fired first to create drafts which pull flames and sparks away from the control line.

stump jumper:
Local terminology for a large brush truck, usually a military type six wheel drive vehicle.

suppress a fire:
The most aggressive wildfire suppression strategy leading to the total extinguishment of a wildfire.

suppression:
All the work of extinguishing or confining a fire beginning with its discovery.

suppression crew:
Two or more firefighters stationed at a strategic location, for initial action on fires. Duties are essentially the same as those of individual firefighters.

suppression firing:
Intentional application of fire to speed up or strengthen fire suppression action on wildfires. Types of suppression firing include burning out, counter firing, and strip burning.

surface fire:
Fire that burns surface litter, other loose debris of the forest floor, and small vegetation.

swamper
1. A worker who assists fallers and/or sawyers by clearing away brush, limbs and small trees. Carries fuel, oil and tools and watches for dangerous situations.
2. A worker on a dozer crew who pulls winch line, helps maintain equipment, etc., to speed suppression work on a fire.

task force:
Any combination of single resources assembled for a particular tactical need, with common communications and a leader.

test fire:
A prescribed fire set to evaluate such things as fire behavior, detection performance, control measures.

torching:
The burning of the foliage of a single tree or a small group of trees, from the bottom up.

unacceptable fire risk:
Level of fire risk above which specific action is deemed necessary to protect life, property and resources.

unified command:
In ICS, unified command is a unified team effort which allows all agencies with jurisdictional responsibility for the incident, either geographical or functional, to manage an incident by establishing a common set of incident objectives and strategies. This is accomplished without losing or abdicating authority, responsibility, or accountability.

values:
As used in fire protection assessment planning, are natural and developed resources (e.g., archeological sites, urban interface) that are developed through an inventory and identification process, then located on a map and their ability to interact with fire determined.

values-at-risk:
Natural resources, improvements, or other values that may be jeopardized if a fire occurs; estimated damages and befits that may result from fires in a particular pre-suppression or suppression situation.

variable danger:
Resultant of all fire danger factors that vary from day to day, month to month, or year to year; (e.g., fire weather, fuel moisture content, condition of vegetation, variable risk).

vertical fuel arrangement:
Fuels above ground and their vertical continuity, which influences fire reaching various levels or vegetation strata. Also called fuel ladders.

visibility distance:
Maximum distance at which a smoke column of specified size and density can be seen and recognized as smoke by the unaided eye.

water supply map:
A map showing location of suppliers of water readily available for pumps, tanks, trucks, camp use, etc.

wet line:
A line of water, or water and chemical retardant, sprayed along the ground, and which serves as a temporary control line from which to ignite or stop a low intensity fire.

wetting agent:
A chemical that when added to water reduces the surface tension of the solution and causes it to spread and penetrate exposed objects more effectively than the untreated water.

wet water:

Water with added chemicals, called wetting agents, that increases waters spreading and penetrating properties, due to reduction in surface tension.

wildfire:
A fire occurring on wildland that is not meeting management objectives and thus requires a suppression response.

Wildfire Task Force:
A entity created through a resolution passed by the Central Pine Barrens Commission on November 8, 1995, that was subsequently modified on December 6, 1995 and January 29, 1997 and March 11, 1998, to undertake pre-fire planning for wildfire suppression response as called for in the Central Pine Barrens Comprehensive Land Use Plan. The Task Force is headed by a chair and co-chairs and its members include representatives from all volunteer fire departments with jurisdiction in the Core Preservation Area of the Central Pine Barrens, private, state and local agencies with vested interest in fire protection of the Central Pine Barrens, fire marshals from the Towns of Brookhaven, Southampton and Riverhead, and the Central Pine Barrens Commission's Law Enforcement Council and Protected Lands Council.

wildland:
An area in which development is essentially non-existent, except for roads, railroads, powerlines, and similar transportation facilities. Structures, if any, are widely scattered.

wildland-urban interface:
The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

APPENDIX B:
ADDITIONAL INFORMATION RELATED TO THE FIRE ENVIRONMENT

B.1: SELECT HISTORY OF MAJOR FIRES ON LONG ISLAND

1839: Two great fires in the Central Islip-Farmingdale area (Tredwell 1912).

1845: A year after the main line of the railroad was completed. "...the extensive and awfully destructive fires, which, in the past season...have swept over immense tracts of land...In several places, the entire forest for 8 or 10 miles in length, and from 2 to 4 miles in breadth, have been completely swept over by the devouring element, which besides destroying every vestige of vegetation, consumed thousands of cords of wood that had been cut and piled..." (Prime 1845).

1848: Peck described the central Suffolk railroad right-of-way as being"as dark and black as the ace of spades, as a most destructive fire had run over it in the month of August 1848; had burned for two weeks and burned over about 75 square miles (Bayles 1873).

1862: A destructive fire originated in Smithtown and swept through Brookhaven into Riverhead and Southampton. This conflagration was "...perhaps of greater magnitude and more destructive in its effect than any other... These annual fires which usually occur in the spring time, when everything is dry,...are most frequently originated by fire from passing trains on the railroads, or by intentional act of vicious persons" (Bayles 1873).

April, 1931: An approximately 15,000 acre fire burned from Port Jefferson Station to Rocky Point Preserve.

1930's: A > 4,000 acre fire burned Brookhaven State Park and the northern portion of Brookhaven National Laboratory.

July, 1964: An approximately 6,000 acre fire burned the Sears Bellows County Park area.

1960's: A > 5,000 acre fire burned in South Yaphank, mostly north of Horse Block Road and south of the LI Expressway.

August, 1995: 1,800 acres burned at Rocky Point Preserve, and 3,000 acres burned in Westhampton, including 225 acres of dwarf pine plains. The 1995 wildfires were unusually severe and large because of extreme drought combined with high fuel loads accumulated in the 65 years since the last major fire.

B.2: "AIDS TO DETERMINING FUEL MODELS FOR ESTIMATING FIRE BEHAVIOR" BY HAL E. ANDERSON (EXCERPT)

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Aids to Determining Fuel Models For Estimating Fire Behavior

Hal E. Anderson

General Technical
Report INT-122
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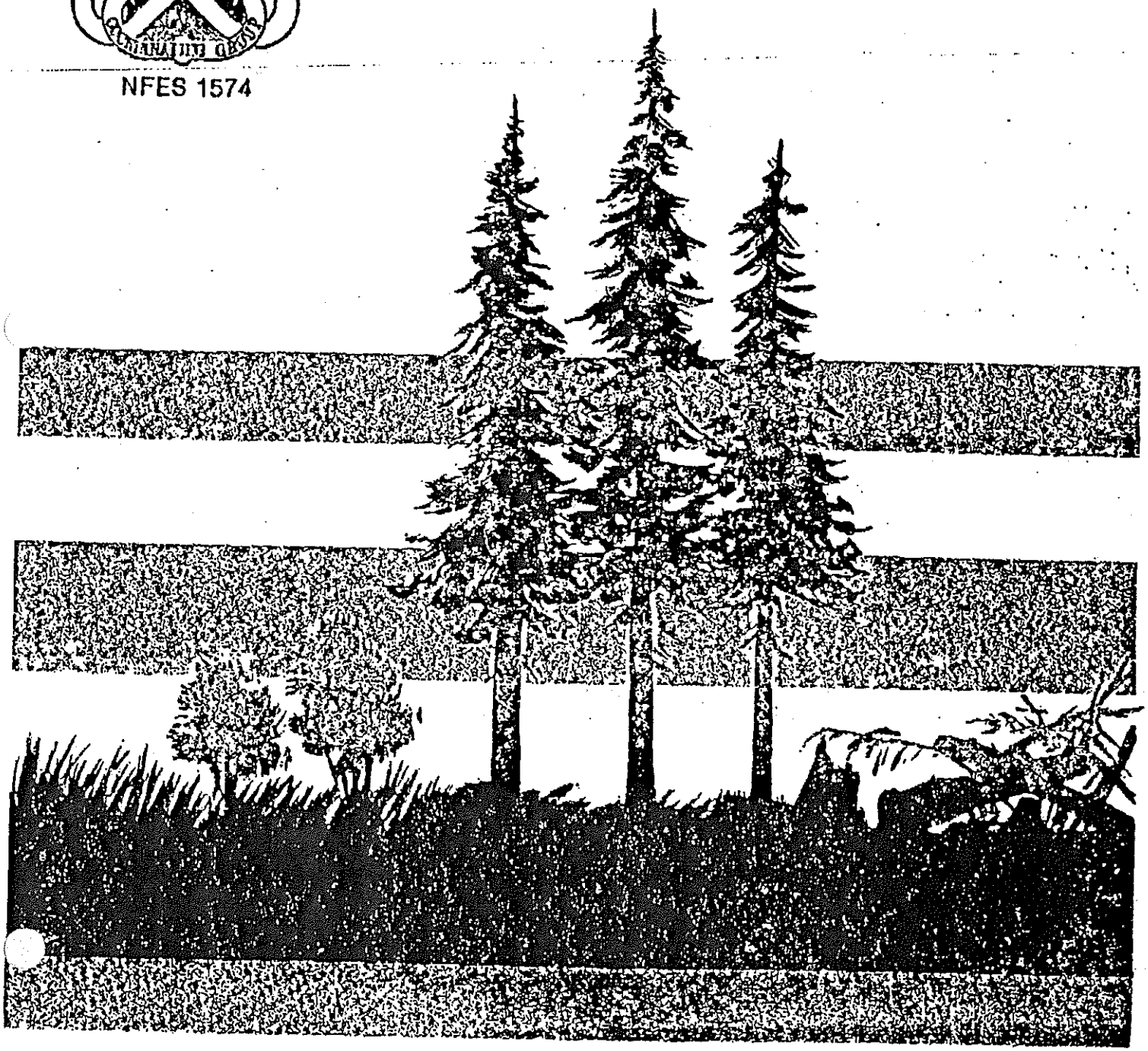
NFES 1574



United States
Department of
Agriculture

Forest Service

Intermountain
Forest and Range
Experiment Station
Ogden, UT 84401

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Aids to Determining Fuel Models For Estimating Fire Behavior

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INTRODUCTION

During the past two decades in the United States, the USDA Forest Service has progressed from a fire danger rating system comprising two fuel models (USDA 1964), to nine models in 1972 (Deeming and others 1972), and to 20 models in 1978 (Deeming and others 1977). During this time the prediction of fire behavior has become more valuable for controlling fire and for assessing potential fire damage to resources. A quantitative basis for rating fire danger and predicting fire behavior became possible with the development of mathematical fire behavior models (Rothermel 1972). The mathematical models require descriptions of fuel properties as inputs to calculations of fire danger indices or fire behavior potential. The collections of fuel properties have become known as fuel models and can be organized into four groups: grass, shrub, timber, and slash. Fuel models for fire danger rating have increased to 20 while fire behavior predictions and applications have utilized the 13 fuel models tabulated by Rothermel (1972) and Albini (1976). This report is intended to aid the user in selecting a fuel model for a specific area through the use of photographic illustrations. A similarity chart allows the user to relate the fire behavior fuel models to the fire danger rating system fuel models. The chart also provides a means to associate the fire danger rating system fuel models with a photographic representation of those fuel types.

HOW FUEL MODELS ARE DESCRIBED

Fuels have been classified into four groups—grasses, brush, timber, and slash. The differences in fire behavior among these groups are basically related to the fuel load and its distribution among the fuel particle size classes. This can be illustrated by the shift in size class containing the maximum fraction of load when considering the four fuel groups shown in figure 1. Notice that the fraction of the total load in the less than ¼-inch (0.6-cm) size class decreases as we go from grasses to slash. The reverse is true for the 1- to 3-inch (2.5- to 7.6-cm) material. In grasses, the entire fuel load may be herbaceous material less than one-fourth inch (0.6 cm), but grass may include up to 25 percent material between one-fourth and 1 inch (0.6 and 2.5 cm) and up to 10 percent material between 1 and 3 inches (2.5 cm and 7.6 cm). Each fuel group has a range of fuel loads for each size class, with maximum fuel load per size class approximately as shown in figure 1.

Fuel load and depth are significant fuel properties for predicting whether a fire will be ignited, its rate of spread, and its intensity. The relationship of fuel load and depth segregates the 13 fuel models into two distinctive orientations, with two fuel groups in each (fig. 2). Grasses and brush are vertically oriented fuel groups, which rapidly increase in depth with increasing load. Timber litter and slash are horizontally positioned and slowly increase in depth as the load is increased. Observations of the location and positioning of fuels in the field help one decide which fuel groups are represented. Selection of a fuel model can be simplified if one recognizes those features that distinguish one fuel group from another.

The 13 fuel models (table 1) under consideration are presented on page 92 of Albini's (1976) paper, "Estimating Wildfire Behavior and Effects." Each fuel model is described by the fuel load and the ratio of surface area to volume for each size class; the depth of the fuel bed involved in the fire front; and fuel moisture, including that at which fire will not spread, called the moisture of extinction. The descriptions of the fuel models include the total fuel load less than 3 inches (7.8 cm), dead fuel load less than one-fourth inch (0.6 cm), live fuel load of less than one-fourth inch (0.6 cm), and herbaceous material and fuel depth used to compute the fire behavior values given in the nomographs.

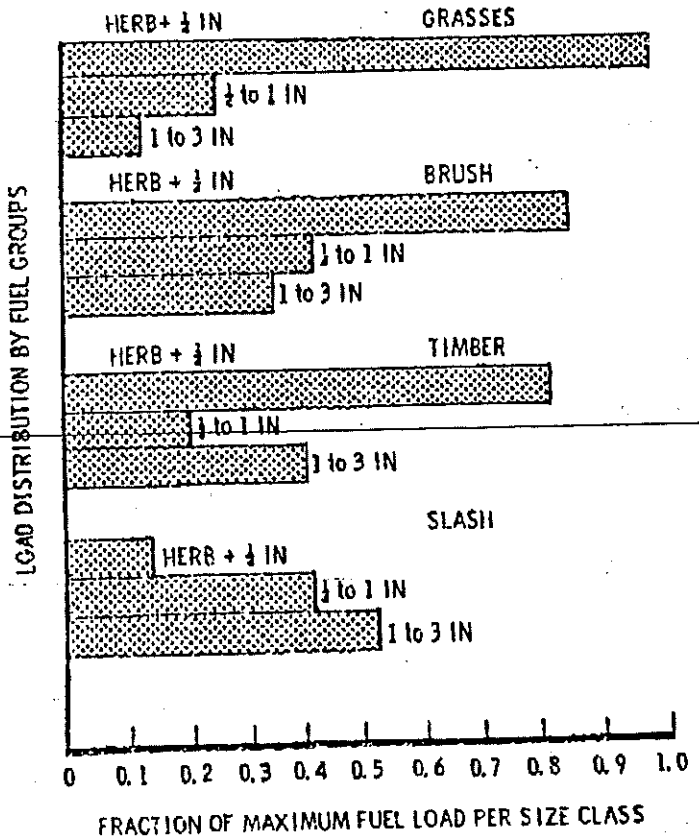


Figure 1.—Distribution of maximum fuel load by size class for each of the four general fuel groups. Note the shift in less than ¼-inch (0.6-cm) and 1- to 3-inch (2.5- to 7.6-cm) material

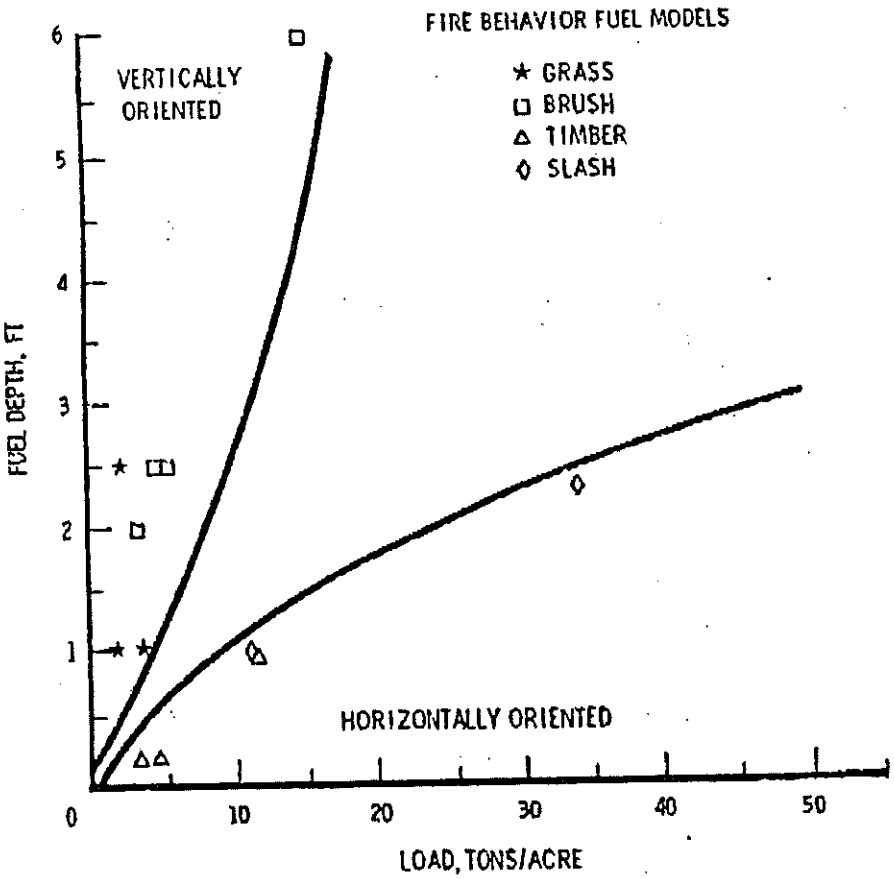


Figure 2.—The four general fuel groups are oriented in two basic directions: vertically, as in grasses and shrubs, and horizontally, as in timber, litter, and slash.

Table 1.— Description of fuel models used in fire behavior as documented by Albini (1976)

Fuel model	Typical fuel complex	Fuel loading				Fuel bed depth	Moisture of extinction dead fuels
		1 hour	10 hours	100 hours	Live		
		Tons/acre				*Feet*	*Percent*
	Grass and grass-dominated						
1	Short grass (1 foot)	0.74	0.00	0.00	0.00	1.0	12
2	Timber (grass and understory)	2.00	1.00	.50	.50	1.0	15
3	Tall grass (2.5 feet)	3.01	.00	.00	.00	2.5	25
	Chaparral and shrub fields						
4	Chaparral (6 feet)	5.01	4.01	2.00	5.01	6.0	20
5	Brush (2 feet)	1.00	.50	.00	2.00	2.0	20
6	Dormant brush, hardwood slash	1.50	2.50	2.00	.00	2.5	25
7	Southern rough	1.13	1.87	1.50	.37	2.5	40
	Timber litter						
8	Closed timber litter	1.50	1.00	2.50	0.00	0.2	30
9	Hardwood litter	2.92	.41	.15	.00	.2	25
10	Timber (litter and understory)	3.01	2.00	5.01	2.00	1.0	25
	Slash						
11	Light logging slash	1.50	4.51	5.51	0.00	1.0	15
12	Medium logging slash	4.01	14.03	16.53	.00	2.3	20
13	Heavy logging slash	7.01	23.04	28.05	.00	3.0	25

The criteria for choosing a fuel model includes the fact that the fire burns in the fuel stratum best conditioned to support the fire. This means situations will occur where one fuel model represents rate of spread most accurately and another best depicts fire intensity. In other situations, two fuel conditions may exist, so the spread of fire across the area must be weighted by the fraction of the area occupied by each fuel. Fuel models are simply tools to help the user realistically estimate fire behavior. The user must maintain a flexible frame of mind and an adaptive method of operating to totally utilize these aids. For this reason, the fuel models are described in terms of both expected fire behavior and vegetation.

The National Fire Danger Rating System (NFDRS) depends upon an ordered set of weather records to establish conditions of the day. These weather conditions along with the 1978 NFDRS fuel models are used to represent the day-to-day and seasonal trends in fire danger. Modifications to the fuel models are possible by changes in live/dead ratios, moisture content, fuel loads, and drought influences by the large fuel effect on fire danger. The 13 fuel models for fire behavior estimation are for the severe period of the fire season when wildfires pose greater control problems and impact on land resources. Fire behavior predictions must utilize on-site observations and short-term data extrapolated from remote measurement stations. The field use situation generally is one of stress and urgency. Therefore, the selection options and modifications for fuel models are limited to maintain a reasonably simple procedure to use with fire behavior nomographs, moisture content adjustment charts, and wind reduction procedures. The NFDRS fuel models are part of a computer data processing system that presently is not suited to real-time, in-the-field prediction of fire behavior.

FUEL MODEL DESCRIPTIONS

Grass Group

Fire Behavior Fuel Model 1

Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through the cured grass and associated material. Very little shrub or timber is present, generally less than one-third of the area.

Grasslands and savanna are represented along with stubble, grass-tundra, and grass-shrub combinations that met the above area constraint. Annual and perennial grasses are included in this fuel model. Refer to photographs 1, 2, and 3 for illustrations.

This fuel model correlates to 1978 NFDRS fuel models A, L, and S.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	0.74
Dead fuel load, ¼-inch, tons/acre	.74
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	1.0

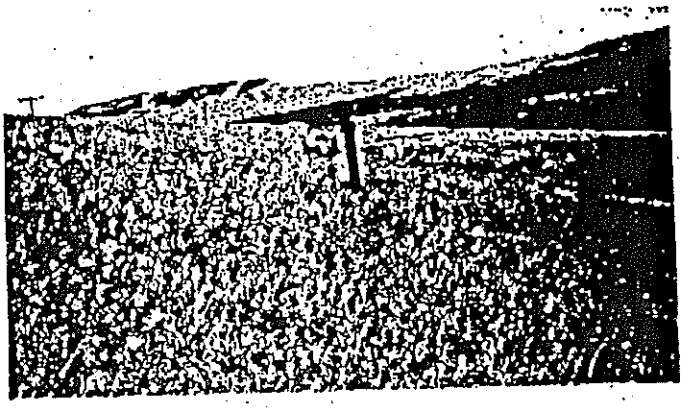


Photo 1. Western annual grasses such as cheatgrass, medusahead ryegrass, and fescues.

Photo 2. Live oak savanna of the Southwest on the Coronado National Forest.

Photo 3: Open pine—grasslands on the Lewis and Clark National Forest

Fire Behavior Fuel Model 2

Fire spread is primarily through the fine herbaceous fuels, either curing or dead. These are surface fires where the herbaceous material, in addition to litter and dead-down stemwood from the open shrub or timber overstory, contribute to the fire intensity. Open shrub lands and pine stands or scrub oak stands that cover one-third to two-thirds of the area may generally fit this model; such stands may include clumps of fuels that generate higher intensities and that may produce firebrands. Some pinyon-juniper may be in this model. Photographs 4 and 5 illustrate possible field situations.

This fuel model correlates to 1978 NFDRS fuel models C and T.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	4.0
Dead fuel load, ¼ inch, tons/acre	2.0
Live fuel load, foliage, tons/acre	0.5
Fuel bed depth, feet	1.0

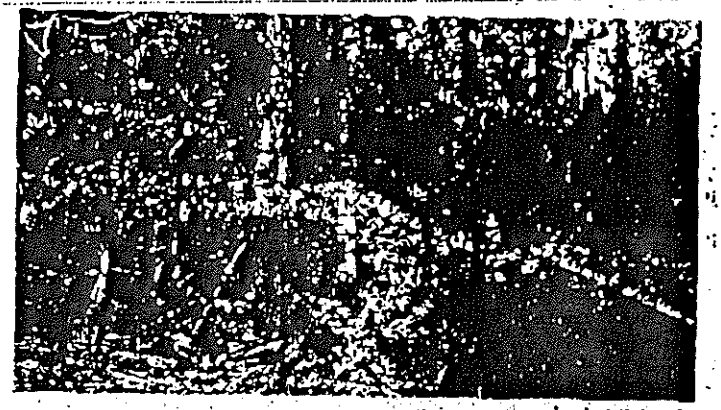


Photo 4. Open ponderosa pine stand with annual grass understory.

Photo 5: Scattered sage within grasslands on the Payette National Forest.

Fire Behavior Fuel Model 3

Fires in this fuel are the most intense of the grass group and display high rates of spread under the influence of wind. Wind may drive fire into the upper heights of the grass and across standing water. Stands are tall, averaging about 3 feet (1 m), but considerable variation may occur. Approximately one-third or more of the stand is considered dead or cured and maintains the fire. Wild or cultivated grains that have not been harvested can be considered similar to tall prairie and marshland grasses. Refer to photographs 6, 7, and 8 for examples of fuels fitting this model.

This fuel correlates to 1978 NFDRS fuel model N.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	3.0
Dead fuel load, ¼-inch, tons/acre	3.0
Live fuel load, foliage tons/acre	0
Fuel bed depth, feet	2.5

Fires in the grass group fuel models exhibit some of the faster rates of spread under similar weather conditions. With a windspeed of 5 mi/h (8 km/h) and a moisture content of 8 percent, representative rates of spread (ROS) are as follows:

Model	Rate of spread *Chains/hour*	Flame length *Feet*
1	78	4
2	35	6
3	104	12

As windspeed increases, model 1 will develop faster rates of spread than model 3 due to fineness of the fuels, fuel load, and depth relations.

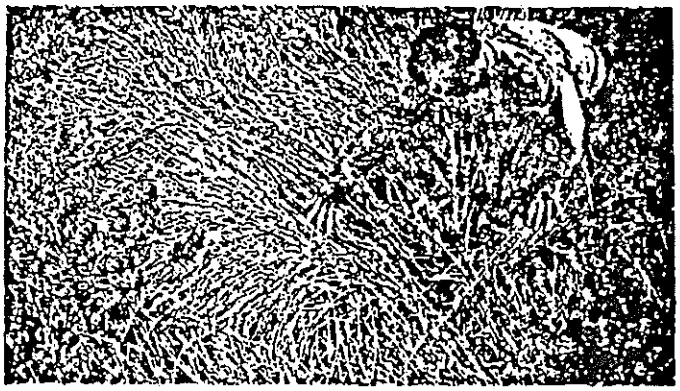


Photo 6. Fountaingrass in Hawaii; note the dead component.

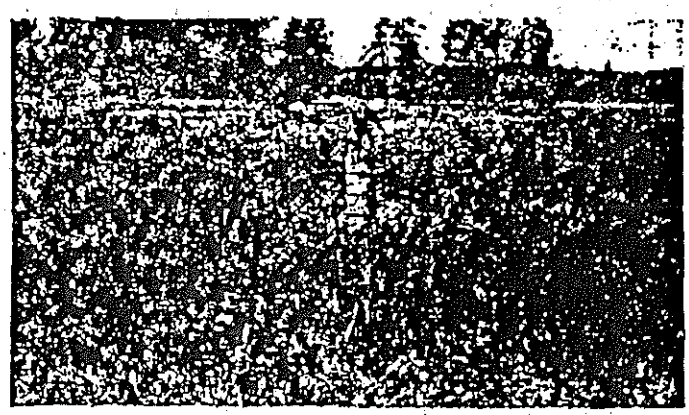


Photo 7. Meadow foxtail in Oregon prairie and meadowland.

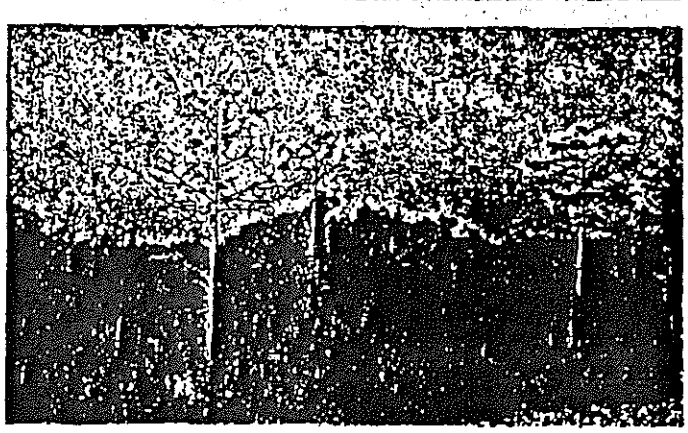


Photo 8: Sawgrass "prairie" and "strands" in the Everglades National Park, Fla.

Shrub Group

Fire Behavior Fuel Model 4

Fire intensity and fast-spreading fires involve the foliage and live and dead fine woody material in the crowns of a nearly continuous secondary overstory. Stands of mature shrubs, 6 or more feet tall, such as California mixed chaparral, the high pocosin along the east coast, the pinebarrens of New Jersey, or the closed jack pine stands of the north-central States are typical candidates. Besides flammable foliage, dead woody material in the stands significantly contributes to the fire intensity. Height of stands qualifying for this model depends on local conditions. A deep litter layer may also hamper suppression efforts. Photographs 9, 10, 11, and 12 depict examples fitting this fuel model.

This fuel model represents 1978 NFDRS fuel models B and O; fire behavior estimates are more severe than obtained by models B or O.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	13.0
Dead fuel load, ¼-inch, tons/acre	5.0
Live fuel load, foliage, tons/acre	5.0
Fuel bed depth, feet	6.0

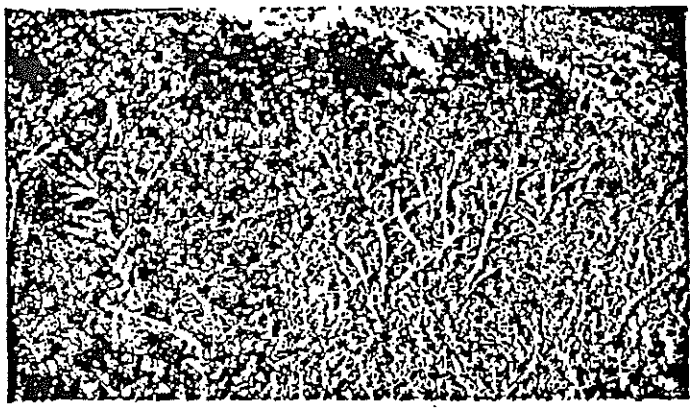


Photo 9. Mixed chaparral of southern California; note dead fuel component in branchwood.

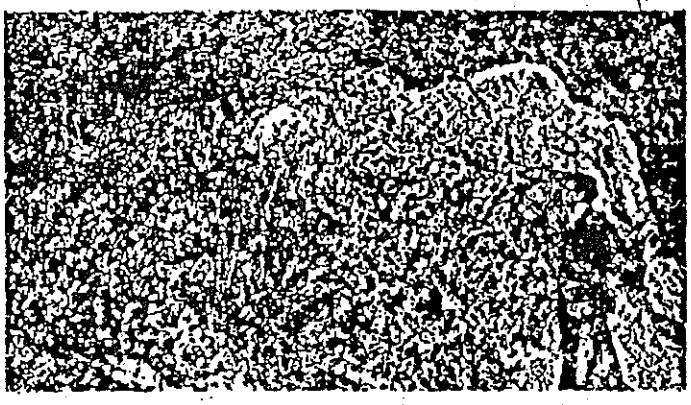


Photo 10. Chaparral composed of manzenita and chamise near the Inaja Fire Memorial, Calif.

Photo 11. Pocosin shrub field composed of species like fetterbush, gallberry, and the bays.

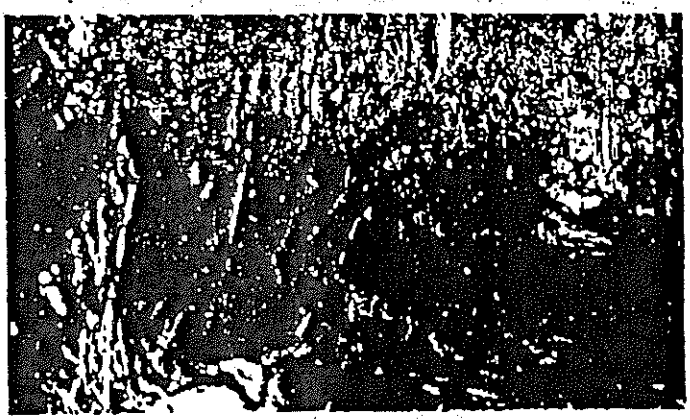


Photo 12. High shrub southern rough with quantity of dead limbwood.

Fire Behavior Fuel Model 6

Fires carry through the shrub layer where the foliage is more flammable than fuel model 5, but this requires moderate winds, greater than 8 mi/h (13 km/h) at mid-flame height. Fire will drop to the ground at low wind speeds or at openings in the stand. The shrubs are older, but not as tall as shrub types of model 4, nor do they contain as much fuel as model 4. A broad range of shrub conditions is covered by this model. Fuel situations to be considered include intermediate stands of chamise, chaparral, oak brush, low pocosin, Alaskan spruce taiga, and shrub tundra. Even hardwood slash that has cured can be considered. Pinyon-juniper shrublands may be represented but may overpredict rate of spread except at high winds, like 20 mi/h (32 km/h) at the 20-foot level.

The 1978 NFDRS fuel models F and O are represented by this fuel model. It can be considered a second choice for models T and D and a third choice for model S. Photographs 15, 16, 17, and 18 show situations encompassed by this fuel model.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	6.0
Dead fuel load, ¼-inch, tons/acre	1.5
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	2.5

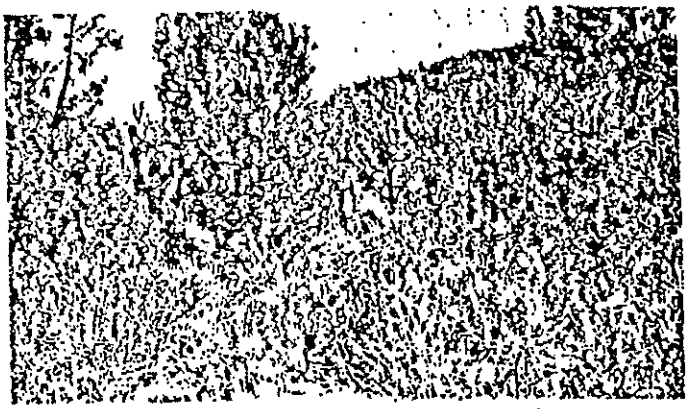


Photo 15. Pinyon-juniper with sagebrush near Ely, Nev.; understory mainly sage with some grass intermixed.

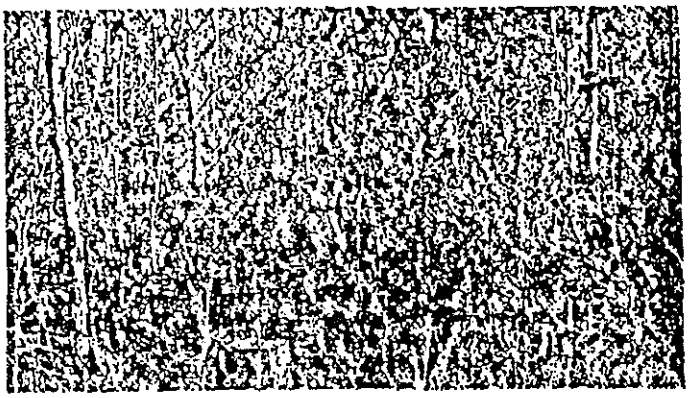


Photo 16. Southern hardwood shrub with pine slash residues.

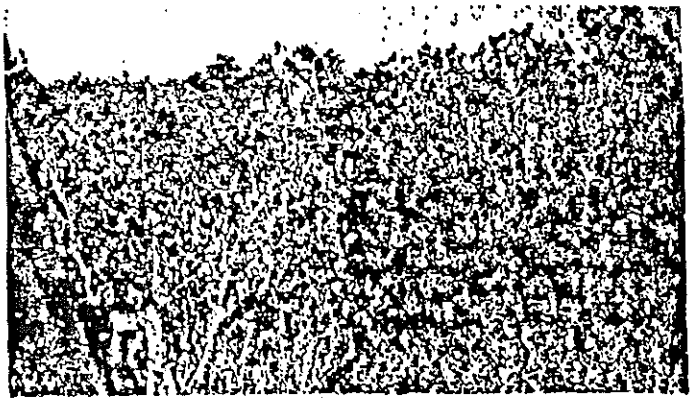


Photo 17. Low pocosin shrub field in the south.

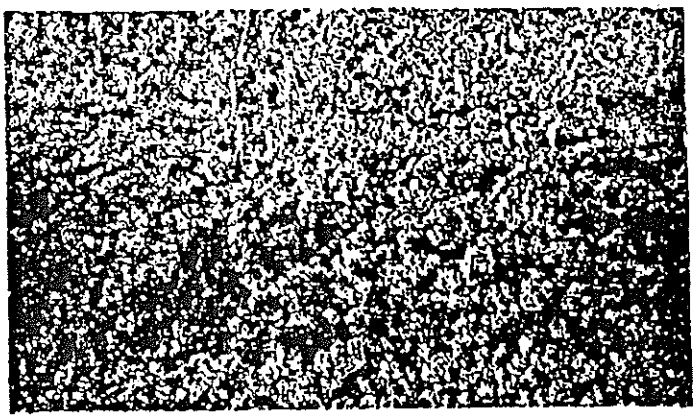


Photo 18. Frost-killed Gambel Oak foliage, less than 4 feet in height, in Colorado.

Timber Group

Fire Behavior Fuel Model 8

Slow-burning ground fires with low flame lengths are generally the case, although the fire may encounter an occasional "jackpot" or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures, low humidities, and high winds do the fuels pose fire hazards. Closed canopy stands of short-needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and occasionally twigs because little undergrowth is present in the stand. Representative conifer types are white pine, and lodgepole pine, spruce, fir, and larch.

This model can be used for 1978 NFDRS fuel models H and R. Photographs 22, 23, and 24 illustrate the situations representative of this fuel.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch, dead and live, tons/acre	5.0
Dead fuel load, ¼-inch, tons/acre	1.5
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	0.2

Photo 22. Surface litter fuels in western hemlock stands of Oregon and Washington.

Photo 23. Understory of inland Douglas-fir has little fuel here to add to dead-down litter load.

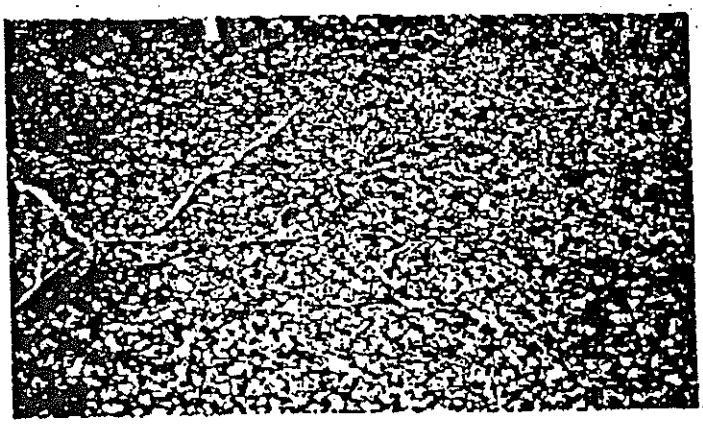


Photo 24. Closed stand of birch-aspen with leaf litter compacted.

Fire Behavior Fuel Model 9

Fires run through the surface litter faster than model 8 and have longer flame height. Both long-needle conifer stands and hardwood stands, especially the oak-hickory types, are typical. Fall fires in hardwoods are predictable, but high winds will actually cause higher rates of spread than predicted because of spotting caused by rolling and blowing leaves. Closed stands of long-needled pine like ponderosa, Jeffrey, and red pines, or southern pine plantations are grouped in this model. Concentrations of dead-down woody material will contribute to possible torching out of trees, spotting, and crowning.

NFDRS fuel models E, P, and U are represented by this model. It is also a second choice for models C and S. Some of the possible field situations fitting this model are shown in photographs 25, 26, and 27.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	3.5
Dead fuel load, ¼-inch, tons/acre	2.9
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	0.2

Photo 25. Western Oregon white oak fall litter; wind tumbled leaves may cause short-range spotting that may increase ROS above the predicted value.

Photo 26. Loose hardwood litter under stands of oak, hickory, maple and other hardwood species of the East.

Photo 27. Long-needle forest floor litter in ponderosa pine stand near Alberton, Mont.

APPENDIX: EVOLUTION OF FUEL MODELS

Introduction

More than 64 years ago, foresters in the United States were concerned about fire danger and were attempting to develop methods to assess the hazard (Dubois 1914). The "inflammability" of a situation depended on four elements: (1) amount of ground fuels; (2) ease of ignition; (3) dryness of the cover; and (4) slope. Three fuel types were considered: grass, brush, and timber. In 1978, we are still concerned about fire danger and fire behavior. Through the use of mathematical fire behavior models (Rothermel 1972) and fire danger ratings (Deeming and others 1977), we can evaluate how fire danger changes with weather, fuels, and slope. In addition, the fire behavior officer on a fire can estimate the fire behavior for the next burning period if he can define the fuels (Albini 1976). Dubois grouped fuels as grass, brush, and timber, and these general groupings are still used with the addition of slash. Several fuel types or fuel models are recognized within each group. For fire danger rating, we have gone from two fuel models (USDA Forest Service 1964) to nine in 1972 (Deeming and others 1972) and 20 in 1978 (Deeming and others 1977). Research efforts to assist the fire behavior officer have utilized the 13 fuel models tabulated by Rothermel (1972) and Albini (1976).

Fuels Defined

Fuels are made up of the various components of vegetation, live and dead, that occur on a site. The type and quantity will depend upon the soil, climate, geographic features, and the fire history of the site. To a large extent, potential evapotranspiration and annual precipitation combinations with altitude and latitude changes can describe the expected vegetation and have been used for vegetation maps (Küchler 1967). An adequate description of the fuels on a site requires identifying the fuel components that may exist. These components include the litter and duff layers, the dead-down woody material, grasses and forbs, shrubs, regeneration and timber. Various combinations of these components define the major fuel groups of grass, shrub, timber and slash. Certain features of each fuel component or the lack of it contributes to the description of the fuels in terms suitable to define a fuel model. For each fuel component certain characteristics must be quantified and evaluated to select a fuel model for estimating fire behavior. The most important characteristics for each component are:

1. Fuel loading by size classes
2. Mean size and shape of each size class
3. Compactness or bulk density
4. Horizontal continuity
5. Vertical arrangement
6. Moisture content
7. Chemical content, ash, and volatiles.

Each of the above characteristics contributes to one or more fire behavior properties. Fuel loading, size class distribution of the load, and its arrangement (compactness or bulk density) govern whether an ignition will result in a sustaining fire. Horizontal continuity influences whether a fire will spread or not and how steady rate of spread will be. Loading and its vertical arrangement will influence flame size and the ability of a fire to "torch out" the overstory. With the proper horizontal continuity in the overstory, the fire may develop into a crown fire. Low fuel moisture content has a significant impact upon fire behavior affecting ignition, spread, and intensity; with high winds it can lead to extreme fire behavior. Certain elements of the fuel's chemical content, such as volatile oils and waxes, aid fire spread, even when moisture contents are high. Others, like mineral content, may reduce intensity when moisture contents are low. High fuel loads in the fine fuel size classes with low fuel moisture contents and high volatile oil contents will contribute to rapid rates of spread and high fire line intensities, making initial attack and suppression difficult.

How Fuels Have Been Described

In the expression of fire danger presented by Dubois (1914), the fuel types of grass, brush, and timber were defined, utilizing three causes—amount of fuel on the ground, lack of moisture in the cover, and slope—and two effects—ease of ignition and rate of fire growth or spread. As Dubois pointed out, however, not enough study had been made of rate of spread to effectively describe differences among the fuel types. Sparhawk (1925) conducted an extensive study of fire size as a function of elapsed time from discovery to initial attack by broad forest cover types. Twenty-one fire regions for the western United States and the Lake States were defined and up to seven forest types selected for each region. These forest types basically were grass, brush, timber, and slash descriptions. The ranking of area growth rates by type showed the highest growth rates occurred in grasses and brush types, followed by slash and open timber situations and concluding with low growth rates in closed timber types. Sparhawk made the following comment regarding his data:

> Rating obtained, therefore, will represent averages of fairly broad application, but may now show what can be expected on individual units. These factors can be allowed for only when the fire records and the inventory of our forest resources include information concerning them.

Show and Kotok (1929) reported on a preliminary study of forest cover as related to fire control. Study of the nine major cover types in northern California showed definite differences between them regarding fire danger, ignition risk, rate of spread, and type of fire and several other fire control subjects. They did not attempt to complete analysis proposed by Sparhawk because the variability of individual fires was so great and the classification of type and hazard classes was so incomplete. However, their nine cover types fit a broader classification of:

1. Woodlands and grasslands
2. Chaparral and brush fields
3. Timber cover types:
   a. western yellow pine and mixed conifer
   b. Douglas-fir
   c. sugar pine-fir and fir.

These cover types and their classification express the broad groupings of grass-dominated, brush-dominated, and timber-residue-dominated fuel groups. Timber residues can be either naturally occurring dead woody or activity-caused slash. In terms of fire behavior, these cover types could be characterized as follows:

Crown fires (occur in secondary or primary overstory)—chaparral and brush types.

Surface fires (occurs in surface litter, dead-down woody, and herbaceous material)—woodlands and grasslands; western yellow pine and mixed conifer; Douglas-fir.

Ground fires (occur in litter, duff, and subsurface organic material)—sugar pine-fir; fir type.

This work showed the complexity of establishing hour control needs and contributes to continued efforts to describe types in terms of fire growth and control difficulty.

Hornby (1935) developed a fuel classification system that formalized the description of rate of spread and resistance to control into classes of low, medium, high, and extreme. For the Northern Rocky Mountains, the standard timber types relative ranking was similar to that of Show and Kotok as well as work in Colorado by Bates (1923) and described by Hornby (1935):

1. Brush—grass
2. Ponderosa pine
3. Larch—fir
4. Douglas-fir and lodgepole pine
5. White pine and lodgepole pine
6. Subalpine fir
7. White fir and spruce.

Classification of these fuels was accomplished by utilizing 90 men experienced in fire hazard. A total of 42 ratings were assigned to typical fuels in Region 1. Hornby noted that a weakness of the system was the use of estimates rather than extensive accurate measurements, but until enough years of data had been collected on contributing influences, some procedures for rating fuels were needed. Adaptations of Hornby's approach have been utilized in the eastern United States (Jemison and Keetch 1942) and modified later in the West (Barrows 1951). Most Forest Service regions utilized some version of the Hornby rating method but generally assigned rate of spread values unique to their area, thereby reducing comparability. This is illustrated by a sampling of the number of ratings used by various regions and some of the variation that existed for rate of spread (ROS) classes.

Region	Year	No. of ratings	ROS (chains/hour)
Region 1	1969	234	High (51)
Region 1	1974	4	High (25)
Region 2	1972	59	High (25)
Region 3	1970	11	
Region 4	1972	48	High (30)
Eastern	1966	15	
Region 5	1973	17	
Region 6	1972	16 examples	High (25)
Region 8	1975		High (>10)
Region 9	1970	10	

The variation of ROS rating is due not so much to fuels alone as to the combination of fuels, climate, season, and local weather. These additional factors influence the quantity of live fuel and the moisture content of the dead fuels. Other agencies such as the BLM have utilized the approach for each management area and have a set of ratings for six areas.

Fuels became a consideration in fire danger ratings in the 1950's; in 1958 an effort was made to unify the eight fire danger rating systems into one national system (Deeming and others 1972). Two fuel conditions were considered—fuels sheltered under a timber cover and fuels in an open, exposed site. A relative spread index was developed and brought into general use by 1965. Review of the approach and the expressed need for the ignition, risk, and energy indexes resulted in a research effort that yielded the 1972 National Fire Danger Rating System (NFDRS). Fuels could be considered in greater detail because a mathematical fire spread model had been developed by Rothermel (1972). Nine specific descriptions of fuel properties, called fuel models, were developed for the NFDRS (Deeming and Brown 1975). Fahnestock (1970), in his guide "Two keys for appraising forest fire fuels," was among the first to use the Rothermel fire spread model. The keys provide tools for recognizing the differences in fuel types and identifying the relative fire hazard potential in terms of rate of spread or crowning. To use the keys, one must describe physical fuel properties in Fahnestock's terms: fine, small, medium for size classes and sparse, open, dense, fluffy, or thatched for compactness or combination of loading and depth. By keying on the fuel properties of the site, one of the 36 rate-of-spread ratings or one of the 24 crowning-potential ratings can be selected.

Fahnestock interpreted the size class descriptions for each fuel stratum according to the physical dimensions and timelags associated with the 1964 NFDRS. Timelag is the time necessary for a fuel size class to change 63 percent of the total expected change. These same descriptions were used when fuel models were developed to represent broad vegetative types of grasslands, brushfields, timbered land, and slash. Within each fuel model, the load was distributed by size or timelag classes, correlated with groupings of foliage and twigs, branchwood, and tree or shrub material as follows:

Size, diameter *inch*	Timelag *Hours*
< ¼	1
¼ to 1	10
1 to 3	100
> 3	1,000[1]

[1]Large fuels or layers slow to respond are recognized in the fuel models available in the 1978 NFDRS.

The initial fuel models were documented by Rothermel (1972) and these 13 models were reduced to 9 models for the 1972 NFDRS (Deeming and others 1972). The original 9 fuel models, except for one, have been retained in the 1978 NFDRS and supplemented by 11 others to accommodate differences across the country. For fire behavior officer training, the 13 fuel models initially presented by Rothermel (1972) and Albini (1976) are currently being used. The 13 models encompass those of the 1972 NFDRS and can be correlated to the 1978 NFDRS models. At the present time, the fuel models have the broadest application, while other research is providing fuel models for specific applications (Kessell 1976, 1977; Bevins 1976; Kessell, Cattelino, and Potter 1977; Philpot 1977; Hough and Albini 1978; Rothermel and Philpot 1973).

PHYSICAL DESCRIPTION SIMILARITY CHART OF NFDRS AND FBO FUEL MODELS

NFDRS MODELS REALINED TO FUELS CONTROLLING SPREAD UNDER SEVERE BURNING CONDITIONS

NFDRS FUEL MODELS	FIRE BEHAVIOR FUEL MODELS													
	1	2	3	4	5	6	7	8	9	10	11	12	13	
A W. ANNUALS	X													GRASS
L W. PERENNIAL	X													
S TUNDRA	X					3rd			2nd					
C OPEN PINE W/GRASS		X							2nd					
T SAGEBRUSH W/GRASS		X			3rd	2nd								
N SAWGRASS			X											
B MATURE BRUSH (6FT)				X										SHRUB
O HIGH POCOSIN				X										
F INTER. BRUSH					2nd	X								
Q ALASKA BLACK SPRUCE						X	2nd							
D SOUTHERN ROUGH						2nd	X							
H SRT- NDL CLSD. NORMAL DEAD								X						TIMBER
R HRWD. LITTER (SUMMER)								X						
U W. LONG- NDL PINE									X					
P SOUTH, LONG- NDL PINE									X					
E HRWD. LITTER (FALL)									X					
G SRT- NDL CLSD. HEAVY DEAD										X				
K LIGHT SLASH												X		SLASH
J MED. SLASH													X	
I HEAVY SLASH														X
	GRASS				SHRUB			TIMBER				SLASH		

Figure 3.—Similarity chart to aline physical descriptions of fire danger rating fuel models with fire behavior fuel models.

APPENDIX C:
DEFENSIBLE SPACE AND HAZARD ASSESSMENT FOR THE WILDLAND/ URBAN INTERFACE

(Except from *Wildland/Urban Interface Fire Protection: A National Problem With Local Solutions,* prepared by the Federal Emergency Management Agency)

Wildland/Urban Interface Fire Protection:

A National Problem With Local Solutions

Textbook

Assessing the Interface

The previous section examined the elements of the wildland/urban interface problem. This section provide a step-by-step guide for assessing your local problem. This assessment examines the components of the interface to identify and document priority problem areas. This model offers a consistent approach and a quantifiable analysis of the priority problem areas in your jurisdiction. Once you have completed the assessment, you can use the results to develop an action plan specifically tailored to your problem. To take action, you have to start somewhere. This section will help you determine where to start and in what direction to go.

There are eight steps in the assessment model:

- Step 1: Identify the Interface
- Step 2: Assign Fuel Hazard Rating
- Step 3: Determine Slope Hazard Rating
- Step 4: Assign Factored Hazard Rating
- Step 5: Assign Structure Hazard Rating
- Step 6: Determine Total Hazard Rating
- Step 7: Establish Interface Priorities
- Step 8: Document Interface Problem.

Step 1: Identify the Interface

The first step in the assessment process is to identify the interface boundary or boundaries on a map. Use a map (preferably a topographic map) of your jurisdictional area and circle your known interface areas. To define these areas accurately, it may be necessary to take a trip into the field or talk to others within the department.

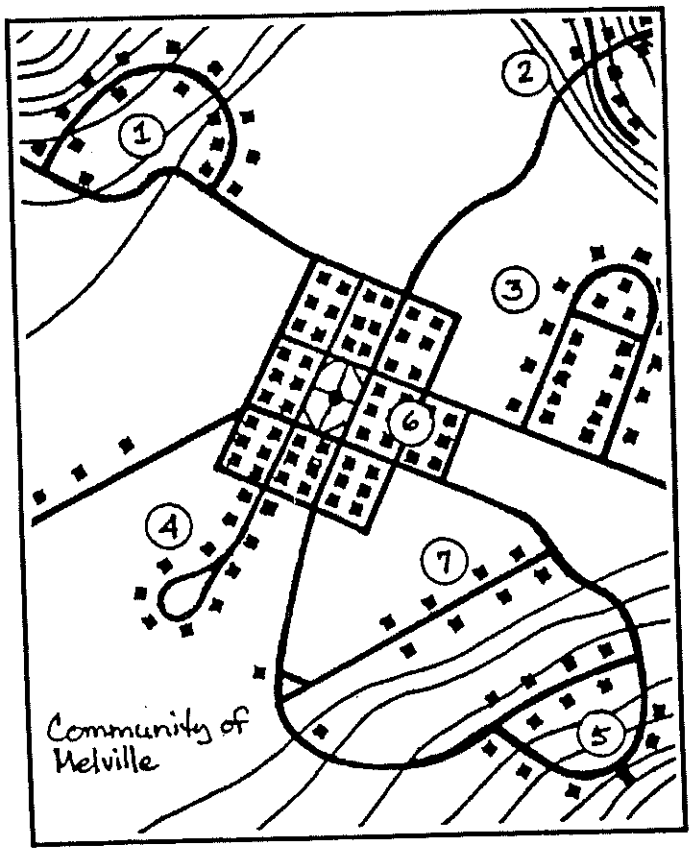
After identifying your interface areas on the map, give each area a name or number. You may wish to name the areas after related geographic names or landmarks for easy reference.

Figure 2-17

Identify interface boundaries

Our example identifies seven interface areas in the Melville community. We have given them the following names:

1. Melville Slopes
2. Melville Cliffs
3. Melville Flats
4. Melville Courts
5. Melville Heights
6. Melville Square
7. Melville Overlook.



Step 2: Assign Fuel Hazard Rating

For each interface area, assign a fuel rating of 1, 2, or 3 based on the following chart.

Fuel Hazard Rating

Type	Rating
1. Small, light fuels (grass, weeds, small shrubs, fine fuels)	1
2. Medium size fuels (brush, shrubs, small trees)	2
3. Heavy, large fuels (woods, trees, timber, heavy large brush)	3

Assign the rating that best represents the primary fuel type in each area. If there are vast differences within the same area, you may choose to subdivide the area into two separate areas. In our example, Melville Slopes includes two distinct fuel-type areas. We will divide Melville Slopes into Melville Slopes Area A and Melville Slopes Area B.

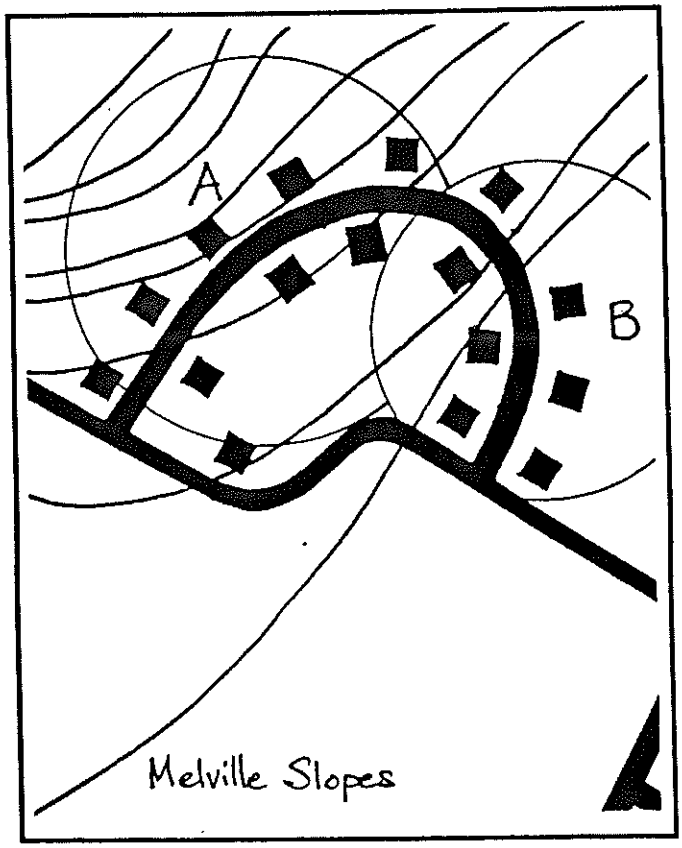


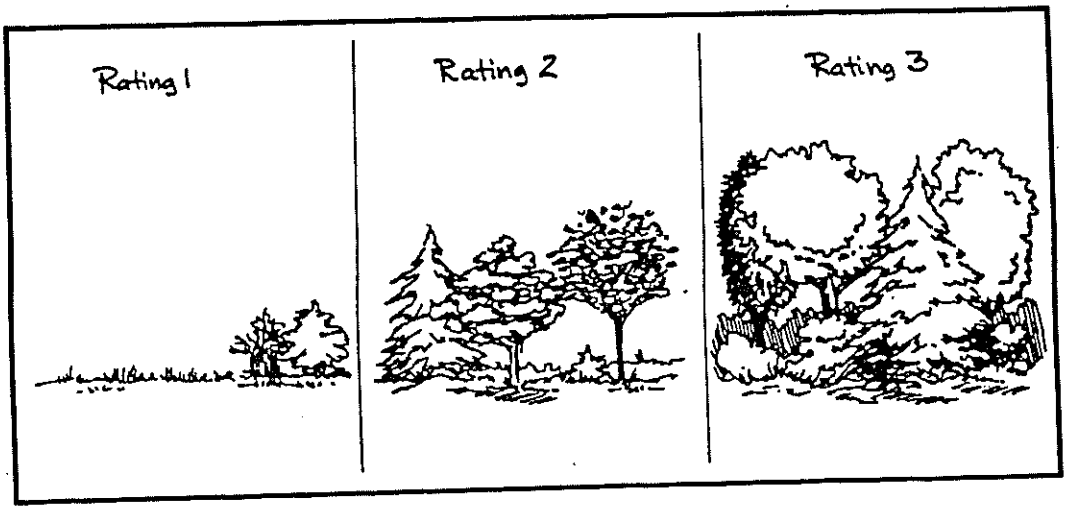
Figure 2-18

Melville Slopes—
Area A
Area B

Figure 2-19

Fuel hazard rating

The following illustration provides a general fuel assessment guide:



Using a chart similar to the one in the next illustration, assign fuel ratings to each area.

Area	Fuel Hazard Rating		Slope Hazard Rating		Factored Hazard Rating		Structure Hazard Rating		Total Hazard Rating
1 MEL. SLOPES (A)	3	X		=		+		=	
1 MEL. SLOPES (B)	2	X		=		+		=	
2 MEL. CLIFFS	2	X		=		+		=	
3 MEL. FLATS	1	X		=		+		=	
4 MEL. COURTS	1	X		=		+		=	
5 MEL. HEIGHTS	3	X		=		+		=	
6 MEL. SQUARE	2	X		=		+		=	
7 MEL. OVERLOOK	2	X		=		+		=	

Step 3: Determine Slope Hazard Rating

In Step 3, you will determine and assign slope ratings. The slope rating will become a factor (or multiplier) of the fuel rating. General slope rating are provided in the following chart:

Slope Hazard Rating

Slope		Rating
1. Flat to mild slope	(0-15%)	1
2. Mild to medium	(16-40%)	2
3. Medium to moderate	(41-60%)	3
4. Moderate to extreme	(61% +)	4

The formula for determining slope is "rise" in 100 feet of "distance" = % of slope.

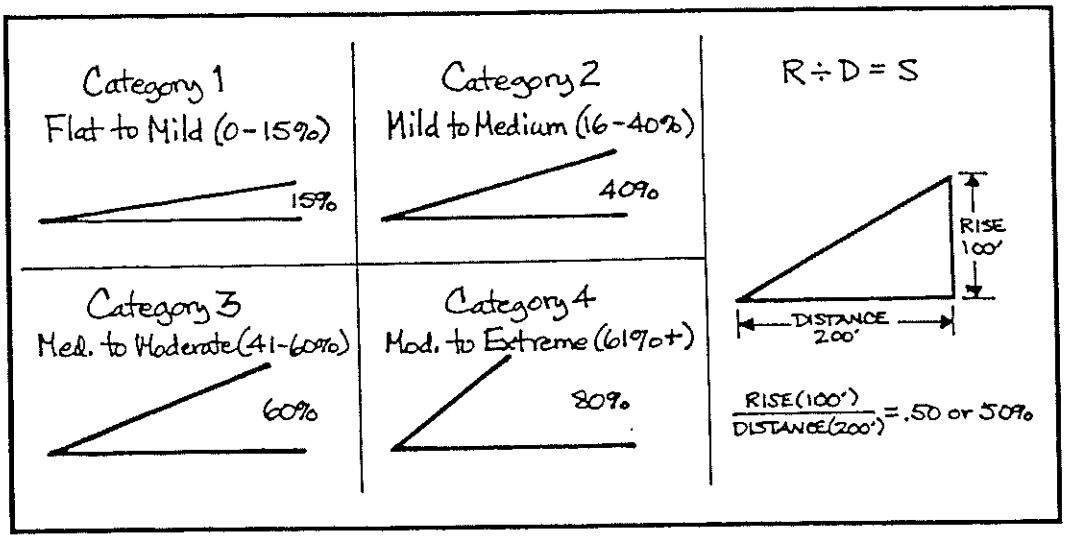


Figure 2-20

Slope hazard rating

Choose the slope that best represents each interface area. If a number of different slope percentages exist (with no obviously dominant slope), take an average. Assign the slope category to the chart.

Area	Fuel Hazard Rating		Slope Hazard Rating		Factored Hazard Rating		Structure Hazard Rating		Total Hazard Rating
1 MEL. SLOPES (A)	3	X	2	=		+		=	
1 MEL. SLOPES (B)	2	X	3	=		+		=	
2 MEL. CLIFFS	2	X	1	=		+		=	
3 MEL. FLATS	1	X	1	=		+		=	
4 MEL. COURTS	1	X	2	=		+		=	
5 MEL. HEIGHTS	3	X	3	=		+		=	
6 MEL. SQUARE	2	X	1	=		+		=	
7 MEL. OVERLOOK	2	X	2	=		+		=	

Step 4: Assign Factored Hazard Rating

Multiply slope ratings by the fuel rating. [A multiplication factor is used because slope has a great influence on the speed of fire spread.] The result of the multiplication becomes the factored hazard rating. For example: Melville Slopes (A) has a fuel rating of 3. Multiplying this by the slope rating (2) results in a factored rating of 6.

Area	Fuel Hazard Rating		Slope Hazard Rating		Factored Hazard Rating		Structure Hazard Rating		Total Hazard Rating
1 MEL. SLOPES (A)	3	X	2	=	6	+		=	
1 MEL. SLOPES (B)	2	X	3	=	6	+		=	
2 MEL. CLIFFS	2	X	1	=	2	+		=	
3 MEL. FLATS	1	X	1	=	1	+		=	
4 MEL. COURTS	1	X	2	=	2	+		=	
5 MEL. HEIGHTS	3	X	3	=	9	+		=	
6 MEL. SQUARE	2	X	1	=	2	+		=	
7 MEL. OVERLOOK	2	X	2	=	4	+		=	

Step 5: Assign Structure Hazard Rating

Structures will be divided into three rating categories based on very general design characteristics. Assign a structure rating to an area that best represents the overall area. Structures within an area will not all be the same. If necessary, assign an average.

Structure Hazard Rating	
1. Roof and siding materials non-wood (generally non-flammable)	**1**
2. Flammable roof materials (wood, shake, or shingle)	**7**
3. Flammable roof and siding materials	**10**

Choose the structure design that best represents each area. Clearly, there will be few occasions when the design characteristics exactly match the definitions in the chart. Where combinations of design characteristics exist within an area or where structural designs do not meet exact definitions, you will have to assign a number. For example, a home or homes with wood siding and non-combustible roofs may be entered with a rating of 3. An interface area with a combination of structures (primarily wood-roofed/wood-siding, but also some wood-roofed/stucco-siding) would be rated 8. Use your judgment to interpolate the ratings for your areas. Then, enter the value into the assessment chart.

Area	Fuel Hazard Rating		Slope Hazard Rating		Factored Hazard Rating		Structure Hazard Rating		Total Hazard Rating
MEL. SLOPES (A)	3	X	2	=	6	+	7	=	
MEL. SLOPES (B)	2	X	3	=	6	+	1	=	
MEL. CLIFFS	2	X	1	=	2	+	7	=	
MEL. FLATS	1	X	1	=	1	+	7	=	
MEL. COURTS	1	X	2	=	2	+	1	=	
MEL. HEIGHTS	3	X	3	=	9	+	10	=	
MEL. SQUARE	2	X	1	=	2	+	7	=	
MEL. OVERLOOK	2	X	2	=	4	+	7	=	

Step 6: Determine Total Hazard Rating

Your analysis is now complete. The last step in your assessment chart is to total the factored value and the structure rating in order to prioritize your interface areas. Do not add the fuel rating or the slope rating. The factored value and the structure rating are the only figures that should be totaled.

Area	Fuel Hazard Rating		Slope Hazard Rating		Factored Hazard Rating		Structure Hazard Rating		Total Hazard Rating
MEL. SLOPES (A)	3	X	2	=	6	+	7	=	13
MEL. SLOPES (B)	2	X	3	=	6	+	1	=	7
MEL. CLIFFS	2	X	1	=	2	+	7	=	9
MEL. FLATS	1	X	1	=	1	+	7	=	8
MEL. COURTS	1	X	2	=	2	+	1	=	3
MEL. HEIGHTS	3	X	3	=	9	+	10	=	19
MEL. SQUARE	2	X	1	=	2	+	7	=	9
MEL. OVERLOOK	2	X	2	=	4	+	7	=	11

Step 7: Establish Interface Priorities

Based on the total score of each area, you have a priority listing of your interface problem areas. List them in order from highest score to lowest. Leave room between each area to write notes concerning the characteristics of each area.

Melville Heights	19
Melville Slopes (A)	13
Melville Overlook	11
Melville Cliffs	9
Melville Square	9
Melville Flats	8
Melville Slopes (B)	7
Melville Courts	3

Note that these scores are based only on the three critical factors of fuel, slope, and structural hazards. However, there may be other factors that will influence the priorities in your community. For example, the infrastructure in a certain portion of the community (available water supply, access by fire service equipment, etc.) may have an effect on your priorities. Remember to use your full knowledge of your community to set protection priorities.

Step 8: Document Interface Problem

Provide a short verbal description of the area and the reason for its rating, with the assigned values and any known risk activities (fire cause history or potential). This information will allow you to identify a more accurate protection strategy when you begin to develop a plan of action. In addition to the information requested, include anything else that you believe might be helpful (e.g., unique weather conditions, unique seasonal use, risk patterns, etc.).

Two area profiles are provided from the Melville examples:

Melville Heights. Melville Heights is a small development in the southeast section of the jurisdiction. The development sits at the top of some small foothills that are covered with heavy hardwood trees and brush. The slope leading to the homes is moderate. The homes are primarily wood sided with wood roofs. Access into the area is on one road (Foothill Ave), a two-way, paved road. The homes in this area are large and located on about one half acre lots. There have been two small wildland fires in the last two years. The suspected cause is children with matches. This is the number one wildland/urban interface problem area in the jurisdiction.

Melville Slopes (A). Melville Slopes is a small development in the northwest section of the jurisdiction. The development is sidehill construction on generally medium slopes. The vegetation is small trees and medium-size shrubs with a grass undercover (ground fuels). The homes are small, primarily with wood roofs and stucco siding. The access (mountain drives) is a two-way dirt and gravel road. This road leads into the development and continues through and out to the north. The area experienced four wildland fires last year. All were related to trash burning.

From Assessment to Action

There is a widespread belief that wildland/urban interface fires are restricted to a few places in the United States. People too often think, "It won't happen to me." The truth is that wildfires are a natural part of the wildland environment. As this chapter has shown, the components of the interface problem exist to varying degrees throughout the United States. The extreme conditions for a wildland fire may occur only rarely in some states, but they do occur.

Defensible space must become a reality in the wildland/urban interface if we are to meet the challenge. With defensible space, there is a chance to be successful when wildland/urban interface fires threaten our communities. In addition, you must begin now to assess the interface fire problem in your locality or jurisdiction. Following the steps outlined in this chapter, you will understand the threat and be better prepared to avert potential disaster.

The following chapter outlines a variety of protection strategies. You should become familiar with all these options, but use the results of the assessment to select those options that best address your interface problems. Chapter 5 will show you how to develop an Action Plan.

APPENDIX D:
RESOURCE LISTING AND OTHER MISCELLANEOUS FORMS

D.1: RESOURCE LISTING

1.	TRAFFIC CONTROL	
	-Fire Department Fire Police	Suffolk County FRES or Rep @ Command Post
	-Suffolk County Police/ Other Police Agencies	Suffolk County FRES or Rep @ Command Post
	-Brookhaven Town Public Safety	Suffolk County FRES or Rep @ Command Post
2.	EVACUATIONS	
	A. Personnel:	
	-Fire Department Fire Police	Suffolk County FRES or Rep @ Command Post
	-Suffolk County Police/ Other Police Agencies	Suffolk County FRES or Rep @ Command Post
	-Brookhaven Town Fire Marshal	Suffolk County FRES or Rep @ Command Post
	B. Transportation (Buses):	
	-Fire Department	Suffolk County FRES
	-Private Companies	
	-School District	
3.	FUEL and GASOLINE	
	-Local Firehouse	
	-Suffolk County DPW Truck	Suffolk County FRES or Rep @ Command Post
	-Marketspan/LIPA	Suffolk County FRES
	-Local Service/Gas Stations	
4.	MECHANICAL (SPARE/REPLACEMENT PARTS and TRAINED PERSONNEL)	
	-Mutual Aid Fire Departments	Suffolk County FRES
	-Marketspan/LIPA (portable mechanics' shop)	Suffolk County FRES
	-Westhampton AFB (Army G.I.s)	Suffolk County FRES or Rep @ Command Post
	-Brookhaven Town Tow-Truck/Retriever	Suffolk County FRES or Rep @ Command Post
	-Local or Over-Night Parts Supply Company	
	-Local Truck Service Company (Firematic/Schunk/Gabriele)	
5.	REHABILITATION ("REHAB")	
	-Community Ambulance Corps.	Suffolk County FRES
	-MCI Trailer - Sayville Community Amb. (Inflatable rubber shelter) 3-28-100	Suffolk County FRES or Rep @ Command Post
	-Private "Port-A-Potty" Company	
6.	FOOD and LIQUID REFRESHMENTS (Signal 8)	
	-Fire Dept. Auxiliary Units (Ladies/Junior FD)	Suffolk County FRES
	-Local Red Cross	Suffolk County FRES

	-Organized community effort -Local stores and markets	Media Announcements
7.	COMMUNICATIONS and COMMAND	
	-Suffolk County Mobile Command Unit	Suffolk County FRES
	-Brookhaven Town Mobile Command Unit	Suffolk County FRES or Rep @ Command Post
	-NYNEX (portable cellular phones and hard-wired phones)	Suffolk County FRES
	-Local buildings (School or other place of assembly)	
8.	BULLDOZERS & HEAVY EQUIPMENT	
	-Brookhaven Town	Suffolk County FRES or Rep @ Command Post
	-Suffolk County DPW [a]	Suffolk County FRES or Rep @ Command Post
	-NYS State DOT [a]	Suffolk County FRES or Rep @ Command Post
	-DEC/Forest Rangers	Suffolk County FRES or Rep @ Command Post
	-Brookhaven National Laboratory	Suffolk County FRES or Rep @ Command Post
	-Private Contractors	

[a]Can not usually request until local resources have been exhausted.

9.	HELICOPTERS	
	-Suffolk County Police (Rescue/Reconnaissance)	Suffolk County FRES
	-DEC/Forest Rangers (Water Drops)	Suffolk County FRES or Rep @ Command Post
	-Westhampton-Air National Guard	Suffolk County FRES or Rep @ Command Post
	-Islip-NY Army Guard (Water Drops)	Suffolk County FRES or Rep @ Command Post

NOTE: Districts should establish their own contract, 24 hour emergency notification procedure, rearrangement of pricing, etc., that is SPECIFIC to their own requirements.

D.2: SIZE-UP FORM

Date: _____ Time: _____ Hrs. Sector/Division: _____

Location of Fire: _____

Size Upon Arrival: _____ acres

Rate of Spread: ☐ Fast ☐ Medium ☐ Slow

Exposures: ☐ Yes ☐ No

Type
- ☐ Residential
- ☐ Business
- ☐ Hazardous Materials

Time until threatened
- ☐ High (Less than 15 min.)
- ☐ Medium (15-30 min.)
- ☐ Low (>30 min.)

Fire Breaks: ☐ Yes ☐ No

Fire Behavior: Fuel Type: ☐ Grass ☐ Scrub ☐ Oak/Locust ☐ Pine
Type of Fire: ☐ Subsurface ☐ Surface ☐ Canopy
_____% Grade of Terrain

Weather:

Temperature:
- ☐ Above 80°F
- ☐ 60-79°F
- ☐ Below 60°F

Wind Speed
- ☐ 0-10 mph
- ☐ 10-15 mph
- ☐ 15-20 mph

Rel. humidity
- ☐ High
- ☐ Low

Wind Direction
- ☐ N
- ☐ NE
- ☐ E
- ☐ SE
- ☐ S
- ☐ SW
- ☐ W
- ☐ NW

Fire weather Index:

☐ 10 Hr. Fuel Moisture Content
- Greater than 6 Fire Danger
  Normal for Long Island
- Less than 6 Fire Danger
  Severe for Long Island

☐ Drought Index
0-200 Low Fire Danger
200-350 Average Fire Danger
350-450 Moderate Fire Danger
450 & Above Severe Fire Danger

Fire Classification:

☐ Type IV - Responding Department & up to 3 Mutual-Aid Departments.
☐ Type III - Responding Department & 3-10 Mutual-Aid Departments.
☐ Type II - County Wide Resources are needed, most ICS positions are filled.
☐ Type I - State and Federal Resources are needed - ALL ICS positions are filled by most qualified personnel.

Completed By: _____

D.3: WILDFIRE CHECKLIST

STRATEGY: ☐ OFFENSIVE: ☐ Direct
- ☐ Aggressive
- ☐ Flank

☐ DEFENSIVE: ☐ Indirect

ALL FIRES:
- ☐ COMPLETE SIZE-UP FORM
- ☐ CLASSIFY FIRE
- ☐ DETERMINE STRATEGY
- ☐ REPORT CLASSIFICATION & SIZE-UP TO DISPATCH
- ☐ ESTABLISH COMMAND
- ☐ START ICS FORM 201

TYPE IV Fire ☐ Is Mutual-aid needed

(If More than 2 Depts. are requested, reclassify to Type III Fire)

☐ No

☐ Yes Who Called: _____

_____

_____

☐ Fill ICS Positions as Needed

☐ IC _____ Name

☐ OPS _____ Name

☐ Staging Officer _____ Name

☐ Type III Fire

☐ Mutual Aid Required

☐ Type _____ Brush Trucks

_____ Tankers

_____ Engines

_____ Ambulances

☐ Fill ICS Positions

- ☐ IC _____
- ☐ OPS _____
- ☐ Staging _____
- ☐ Logistics _____
- ☐ PIO _____

☐ Type II Fire

Same as Type III but notify County Dispatch that County resources are needed to Control/Extinguish this Fire.

☐ Type I Fire

Same as Type II Fire but notify County Dispatch that State or Federal Resources are needed to Control/Extinguish this Fire.

☐ Call for Command Van

☐ Set Up Rehab Area

☐ Call for Town/County Coordinators

Note: If more than 10 mutual aid departments are needed, reclassify to a Type II Fire. Start and complete ICS Form 201.

D.4: STAGING AREA FORM

Unit Number	Type	Assigned Yes/ No	Assignment	Radio Frequency	Time In	Time out

D.5: WILDFIRE BRIEFING FORM

Date : _____ **Time:** _____

Time Assigned: _____ HRS Time Completed:_____HRS

Unit Number	Unit Type	# Personnel
	Sector Commander	2

Operational Assignment:

Special Instructions:

Freq.	Assignment	Chan.
	Command	F - 1
	Sector	F - 2
	Sector	F - 3
	Emergency	F - 4

Prepared by: _____ Approved by: _____

Given by: _____ Received by: _____

D.6: TEN STANDARD FIRE ORDERS

Fight fire aggressively but provide for safety first.

Initiate all action based on current and expected fire behavior.

Recognize current weather conditions and obtain forecasts.

Ensure instructions are given and understood.

Obtain current information on fire status.

Remain in communications with crew members, your supervisor and adjoining forces.

Determine safety zones and escape routes.

Establish lookouts in potentially hazardous situations.

Retain control at all times.

Stay alert, keep calm, think clearly, act decisively.

APPENDIX E:
POST INCIDENT RECOVERY CHECKLIST AND SPECIAL FIRE REPORT

E.1: POST-INCIDENT RECOVERY CHECKLIST

Note: The following section is reprinted from "Fire Officers Guide to Disaster Control" by William M. Kramer and Charles W. Bahme, with the permission of William M. Kramer.

I. Evaluation Method:
- A. Review the hazard analysis (was the emergency anticipated).
- B. Review documentation compiled during the response phase.
- C. Obtain outside input (local, state, federal, researchers).
- D. Evaluate public reaction or criticism.
- E. Hold critique sessions among emergency responders.
- F. Interview involved agency heads.

II. Evaluation Criteria:
- A. Direction, Control and Coordination
  1. Were strategy and tactic effective?
  2. Was the command organization effective?
  3. Were control preparations effective?
  4. Were resources adequate?
  5. Were mutual aid procedures adequate?
  6. Was coordination among external agencies adequate?
- B. Alerting and Warning
  1. Was warning information heeded?
  2. Were there preventable injuries or fatalities?
- C. Communications
  1. Were there major hardware failures?
  2. Were emergency notifications made?
  3. Were field tactical communications adequate?
  4. Were EOC/field communications adequate?
  5. Were there problems in receiving requests for emergency services from the public?
- D. Emergency Public Information
  1. Were there complains from the public?
  2. Were there complaints from the news media?
  3. Were there excessive rumors and misinformation?
  4. Was there conflicting information distributed by government agencies?
  5. Were emergency information bulletins/recommendations heeded?
  6. Was the public response appropriate?

7. Did the public receive sufficient information?

E. Assessment of Hazards to Responders
Were personnel injured or resources lost unnecessarily?

F. Size-Up and Situation Status
Was available information sufficient for action planning?

G. Evacuation and Sheltering
1. Was evacuation conducted in time?
2. Were transportation resources adequate?
3. Were shelter facilities adequate?
4. Was temporary housing (if long term) adequate?
5. Were food and support adequate?

H. Law Enforcement
1. Was perimeter/traffic control adequate?
2. Was control of criminal activity adequate?
3. Were evacuation efforts of law enforcement agencies adequate?

I. Fire Suppression
1. Were fires contained and controlled?
2. Were there adequate firefighting sources (including water)?
3. Were search and rescue efforts effective?
4. Were hazardous material leaks controlled?
5. Were mutual aid plans effective?

J. Medical/Mass Casualty
1. Was patient triage adequate?
2. Was field treatment appropriate and adequate?
3. Was distribution of casualties to hospitals adequate?
4. Were there sufficient resources including manpower, ambulances, equipment and supplies?
5. Was management of fatalities appropriate and adequate?
6. Were casualty lists prepared and released appropriately?

K. Public Works
1. Was debris cleared adequately?
2. Were public facilities protected (including sewers, waste treatment, dams, flood control facilities, reservoirs, aqueducts, cisterns)?
3. Was support in assessing damage adequate?

L. Transportation
1. Were transportation resources adequate?
2. Was maintenance/repair of transportation facilities (airports, roads, bridges, railways, mass transit systems, pipeline) adequate?

M. Human Services and Distance Relief

1. Were the following items available from relief agencies
    a. Food
    b. Counseling
    c. Clothing
    d. Sheltering/temporary housing
    e. Nonemergency medical needs (medicine, oxygen, appliances)
    f. Money (for rent, food, etc.)

N. Utilities
1. Was service returned in a reasonable time?
2. Were resources (regular, standby, emergency alternate) adequate?

O. Administration
1. Were purchasing procedures adequate?
2. Was legal advice timely and adequate?
3. Were critical government records preserved?
4. Were overall emergency response costs adequately documented?

P. Recovery
1. Was there adequate funding available for necessary recovery activities?
2. Did recovery include provisions to prevent or minimize future emergencies?
3. Was there prompt response to requests for funds?

Q. Hazard Identification
1. Was the hazard identified as a serious threat before the emergency?
2. Was the analysis of primary and secondary effects accurate?
3. Was the hazard corrected to prevent recurrence?

E.2: SPECIAL FIRE REPORT
All Wildfires in the Central Pine Barrens Core Preservation Area

FAX TO: DEC FOREST RANGERS OFFICE - 444-0297
FAX SENT: TIME: _____ DATE: _____

Fire Department - Incident Commander to complete

Alarm Date: _____ Incident No: _____ FD ID: _____

Alarm Time: _____ Time in Service: _____

Location - G.P.S.: N ____ W ____ OR General Map: _____

Alarm Reported by: Name: _____ Phone: _____

Total Acres burned: (Check one) _____ 0 to 1/4 Acre _____ 1/4 to 9.9 Acres

_____ 10 to 99.9 Acres _____ 100 to 299.9 Acres _____ Over 300 Acres

Ignition Factor, if known: _____

Approx. No. of Firefighters, Your Dept: _____ Mutual Aid: _____

Number of Injuries, Firefighter: _____ Civilian: _____

FIRE APPARATUS:	Number of Units	
	Your Dept.	Mutual Aid
Brush Trucks	_____	_____
Tankers	_____	_____
Pumpers	_____	_____
Ambulances	_____	_____

List all Mutual Aid Fire Departments Called:

_____ _____ _____
_____ _____ _____

Other Resources called (list type and Agency):

_____

_____

Name of Incident Commander: _____

Name of Person Complete Report: _____

Name and Phone Number to contact for additional information:

Name: _____ Daytime Phone: _____

APPENDIX F:
WILDFIRE TRAINING COURSES

WILDFIRE TRAINING COURSES

The Suffolk County Fire Academy could provide the following courses:

1.	Essentials	12 hrs.
2.	Unified Incident Command	25-30 hrs.
3.	Basic Wildland Suppression (county's version)	2.5 hrs.
4.	Wildfire Safety Course (county's version)	2 hrs.
5.	Communications Discipline and Protocol	

New York State or the National Wildfire Coordinating Groups (NWCGs) are available to provide the following courses:

1.	Basic Fire Suppression (NYOFP)	12 hrs.
2.	S-130 Firefighter training To give the basic skills in suppression with hands-on experience	24 hrs.
3.	S-190 To give the basic behavior factors to aid in safe and effective control **S-130/190 with a physical agility test, could "Red Card" firefighters to respond to out of state fires, as a team, designated by the State of NY.	6 hrs.
4.	PMS 416 Standards for Survival Emphasis is placed on avoiding situations and conditions that are unsafe.	8 hrs.
5.	S-200 Initial Attack Incident Command Provide the training needed to size-up, deploy, suppress, communicate and administrate small non-complex fires.	24 hrs. max.
6.	S-205 Fire Operations in Urban Interface Provides training needs for initial attack IC and company officers confronting wildland fires that threatens life, property, and improvements.	32 hrs. max.
7.	P-101 Intro to Wildfire Prevention General knowledge about prevention, problems, specific actions and the role of prevention specialist.	2 hrs.
8.	P-151 Wildfire Cause and Origin The training is for potential wildfire investigators	29 hrs.
9.	I-100 Intro to ICS	Self study

10.	I-200 Introduces the student to the principles of Incident Command	12 hrs.
11.	I-300 Describes in more detail and examples of the organization and operations.	27 hrs.
12.	PMS-418 HazMat Awareness To provide training in awareness and recognition of Hazardous Material.	2 hrs.
13.	S-217 Interagency Helicopter Training Guide Basic knowledge and skills to work with helicopters.	35 hrs.

APPENDIX G:
CENTRAL PINE BARRENS
CORE PRESERVATION AREA FIRE DISTRICTS

CENTRAL PINE BARRENS
CORE PRESERVATION AREA FIRE DISTRICTS

The following 17 fire districts are those whose jurisdiction contains some portion of the Core Preservation Area of the Central Pine Barrens defined by the state pine barrens law:

Brookhaven Fire District
East Quogue Fire District
Eastport Fire District
Flanders Fire District
Gordon Heights Fire District
Hampton Bays Fire District
Manorville Fire District
Middle Island Fire District
Miller Place Fire District
Quogue Fire District
Ridge Fire District
Riverhead Fire District
Rocky Point Fire District
Wading River Fire District
Westhampton Beach Fire District
Westhampton Fire Protection District
Yaphank Fire District

Currently, for all of these districts except the Westhampton Fire District, there is a corresponding fire department of the same name which is a member of the Wildfire Task Force. Since the Westhampton Fire District does not currently have an organized fire department, that district is currently a Wildfire Task Force member itself, to be replaced as a member by any future fire department which may be organized under it.

APPENDIX H:
REFERENCES

REFERENCES

Anderson, Hal E., 1982, *Aids to Determining Fuel Models For Estimating Fire Behavior*, National Wildfire Coordinating Group, General Technical Report, INT-122, April 1982.

Backman, A. E., 1984. *"1000-year record of fire-vegetation interactions in the northeastern United States: A comparison between coastal and inland regions"*. MS Thesis, University of Massachusetts, Amherst, MA.

Bayles, R., 1873. *Historical and Descriptive Sketches of Suffolk Co., Port Washington, New York.* As quoted by Turano, F., 1983. Long Island Forests: A Historical Perspective. Unpublished manuscript.

Central Pine Barrens Joint Planning and Policy Commission, 1995, *Central Pine Barrens Comprehensive Land Use Plan, Volume 2*, Great River, New York, June 28, 1995.

Consolidated Laws of New York Annotated Town Law, Chapter 62, *Article 11-- Fire, Fire Alarm and Fire Protection Districts, Sections 170 to 189a..*

Federal Emergency Management Agency (FEMA), *Wildlard/Urban Interface Protection: A National Problem With Local Solutions.*

International Association of Fire Chiefs and Western Fire Chiefs' Association, 1996, *Development Strategies in the Wildland-Urban Interface.*

Long Island Business News, *1997 Long Island Almanac*, Supplement to Long Island Business News, Ronkonkoma, New York.

Morton, T. 1632. New English Canaan, *In: Tracts and Other Papers Collected by Peter Force, 1836. Reprinted Peter Smith, 1963, Gloucester, Mass.* As quoted by Cronon, W, 1983. *Changes in the Land: Indians, Colonists and the Ecology of New England.* Hill and Wang, New York.

National Wildfire Coordinating Group, 1989, *Fireline Safety Reference Booklet* (NFES 2243), National Interagency Fire Center, Boise, Idaho, November, 1989.

National Wildfire Coordinating Group, 1996, *Glossary of Wildland Fire Terminology* (NFES 1832), National Interagency Fire Center, Boise, Idaho, November, 1996.

New York State Environmental Conservation Law, 1993, Chapters 262 and 263 of the New York State Laws of 1993, Article 57, *Long Island Pine Barrens Protection Act,*

July 14, 1993.

Prime, N. S. A., 1845. *History of Long Island: from its first settlement by Europeans to the year 1845*. As quoted by Turano, F. Long Island Forests: A Historical Perspective. Unpublished manuscript 1983.

Reiners, W.A., *"Ecology of a heath-scrub synusia in the pine barrens of Long Island, New York."* Bull. Torrey Bot. Club 92 (1965): 4418-464.

Reiners, W.A., *"Relationships between vegetation strata in the pine barrens of central Long Island, New York"*. Bull. Torrey Bot. Club 94 (1967): 87-99.

Simmerman and Fisher, 1990. *Wildland Home Fire Risk Meter.*

Suffolk County Planning Department, 1984. *Data Book - Suffolk County: A Place to Enjoy*, Hauppauge, New York, December, 1984.

Tredwell, D. M. ,1912. *Personal reminiscences of Man and Things on Long Island.* Charles Ditmas, Brooklyn, N.Y. As quoted by Turano 1983.

Windisch, A. W., 1994. *A preliminary wildfire history for the Long Island Central Pine Barrens.* Report to The Nature Conservancy, Cold Spring Harbor, New York.

Wood, W. New England's Prospect. 1634. (Prince Soc. ed., Boston, 1865), as quoted by Day, G. M., 1953. *"The Indian as an ecological factor in the northeastern forest"*. Ecology 34:329-346.