

Northeast

THE NORTHEAST AREA

I. INTRODUCTION

II. THE NORTHEAST AREA

- A. Forest Types - There are 11 major cover types in the area. The most common is Oak - Hickory (Fire Behavior models 8 and 9) that is found in all 20 states. Of these I am going to be talking about the Spruce-Fir (Fire Behavior models 4 or 10) of New England and Northern Minnesota, the Pine Barrens of New Jersey, (Fire Behavior model 4) the Jack Pine/Red Pine (Fire Behavior model 6) areas of the Lake States, and the peat/muck fuels found in the northeast and elsewhere in the US. Some of the others which play a major role in a normal fire season are common to the Southeast or Plains and have been or will be discussed by other instructors in their presentation.
- B. Topography - The Northeast Area is the same as the USFS's Eastern Region. It is a 20-state rectangle with the 4M corners - Minnesota to Maine to Maryland to Missouri. It is relatively flat with elevations ranging from sea level to 6,288 feet above sea level. Compare this to the 7,294 feet of elevation change that takes place between here and Mount Lemmon, 32 air miles away! While local topography may cause some concerns, the overall impact is not significant except in the mountainous areas in the New England and Mid-Atlantic States.
- C. Weather - The fire weather season in the Northeast usually lasts from March through November. It is characterized by a spring fire season that starts in the southern part of the area and moves northward. By mid-June the major period has passed and there will usually be a full until early or mid-September when the fall fire season begins. How soon we start to get frost and the maturing of the fine fuels and hardwood leaves will determine when the major fire activity fire activity begins. The season moves slowly southward and will usually end in mid-November in most of the area. Although we can experience extreme fire behavior and sever fires in fall, the chances are lessened by the shorter, cooler days, nightly frost, and limited drying periods.

Unless it has been an unusually dry summer and fall the only serious problems will occur with the weather system known as "Indian Summer". This is a period of two to five days when we get a stagnant, dry high pressure system in the area. Temperatures in the 80's are not uncommon; relative humidities will drop to the middle or low teens, and the winds will usually blow from a southerly direction. Speeds may vary from 3 to 13 miles per hour with gusts up to 18-25 being common. Some other characteristics of this pattern are limited relative humidity recovery at night; minor nighttime temperature changes; continuous winds, even after dark; and very hazy conditions which reduce visibility to two miles or less.

Four of the six synoptic weather types, all associated with high pressure systems and periods of critical forest fire weather in the United States are found in the Northeast Area. They are:

1. Pacific High.
 - a. Loses moisture crossing the Rocky Mountains; arrives in the Northeast as a dry continental air mass. Usually about three days from the time it crosses into the Continental U.S. before it arrives.
 - b. More numerous than any other type of system.
 - c. Often tracks southeast across the bottom of the region. Can give the Southeast more problems than the Northeast.
 - d. If the preceding cold front is dry, high fire danger occurs in the post frontal area.
 - e. The western or northwestern side is usually the most dangerous side of the system.
2. Northwestern Canadian High.
 - a. Is dry to begin with because it originates over land.
 - b. All sides can be dangerous, but the north and northwest sides are the most critical.
3. Hudson Bay High.
 - a. Tends to stagnate in the Hudson Bay area.
 - b. Moves south into the United States so it passes right over the Lake States on its way.
 - c. The greatest danger usually occurs on the Northwest side of the high.
 - d. The longer the system is with you, the more the visibility deteriorates. Can get as low as two miles or less.
 - e. Most frequent in the spring and fall.
4. Bermuda High.
 - a. Long lasting and stagnate type of system.
 - b. Frequent in spring, early summer and fall.
 - c. Quite often extends into Texas to block the flow of moisture from the Gulf of Mexico. Type of system said to cause a lot of the

drought type conditions that existed in the NE in the spring and early summer of 1988.

- d. Low humidities and high temperatures common with this type.
- e. The worst winds for fires occur when low pressure troughs pass by a stagnant Bermuda High on its north side.

Dominic Scaffidi, former fire weather forecaster for Wisconsin adds the Alberta Low to this list as a catalyst, especially when it follows on the heels of the one of the highs just listed. This type of system can prompt a dry lightning situation along with high winds. It was this combination, which moved across a very narrow band of northern Minnesota, Wisconsin, and Upper Michigan on May 6, 1986, with surface winds of 50 - 60 MPH. During its passage a USFS prescribed burn escaped mop-up for 1,000 acres, a major forest fire of 8,000 acres threatened an air force base on Michigan's Upper Peninsula, and 80 power line fires were started in a three-county area of northern Wisconsin.

In addition to the systems mentioned, the Atlantic Coast can have occasional high fire danger associated with tropical storms when the windy area reaches beyond the wind and cloud shield.

Mobile weather vans and forecasters are not standard equipment in the Northeast, but we do have a good system of fire weather forecasters located in the region. Several of them have attended specialized fire weather forecasting training at either Boise or Marana and are familiar with fire behavior and the problems associated with fires in their area.

Although you might request a van and a forecaster at the site, and may get them, you will probably be just as successful if you take good on-site observations and call them by to the fire weather forecaster by telephone. One thing I do want to emphasize is to use these people, especially in the Lake States. They are familiar with the problems the Great Lakes can cause. Teams that have come to us in the past that has used this local resource have experienced problems.

D. Strategy.

A full control strategy using direct or flanking attack will be the most common one you will use. These strategies are driven by two major factors:

1. Federal land ownership is a very minor part of the total landscape, and, in some instances may even be a minor part of the holdings within the boundary of the property. At the same time the number of qualified fire personnel and the fire equipment on the federal properties is limited to nonexistent. Several of the states protect the federal property under contract to the agency.
2. Time is the second major factor. Almost all project fires will complete their run during the first day of the burn. They may burn through the

night, but by morning of the second day they will have ended because of a change in fuel type, successful control by the local agency, or a combination of the two. If you are called in as a Type I team, it will probably be a deal with a series of incidents that have already occurred, or to be there for incidents which are expected to happen in the immediate future.

3. The exceptions may be found in the national parks, such as Voyagers and Isle Royal, and in the USFS's Boundary Water Canoe Area in northern Minnesota where indirect attack or a confinement strategy may be used in areas of large federal ownership to meet agency specific land management objectives.

E. Tactics.

1. Tactics will usually involve the use of mechanized line construction by tractor and plow or dozer units reinforced by hand tool crews.
2. In some parts of the Northeast water lines or variations involving the use of foam and water will be the primary tactic for suppression. Hand tools such as the backpack pumps, fire rake, shovel, McLeod tool and fire swats are standard equipment for fire agencies of all types.
3. Volunteer fire departments are a major resource used by many of the states and some federal agencies. Depending upon the particular area, their wildland capabilities will vary from a few structural engines that will not leave a hard-surfaced road to those that have highly specialized wildfire equipment.
4. Limited use is made of aerial suppression equipment. Helicopters with foam injection buckets, agency owned or contracted aerial tankers and single engine air tankers (S.E.A.T.) are used in Maine, Michigan, Minnesota, New Jersey, Pennsylvania, and Wisconsin. Federal and state agencies may share equipment under "Call When Needed" contracts. In Minnesota, the state and USFS use a small fleet of float equipped Beaver aircraft for suppression, detection, and transportation. Extensive use is made of state owned aircraft for detection and direction of ground forces on going incidents. Density altitude is not usually a problem for aircraft operations in the northeast.

F. Special Considerations.

1. Safety
 - a. Check with your local resource advisor for specifics, but some special safety problems you may encounter are:
 - (1) Black Bears - Most likely to encounter them in northern Minnesota, northern Wisconsin, and northern Michigan.

Usually will leave you alone, but in a drought year when there is an absence of natural food, such as berries, they will raid camps in search of food. Proper storage of open food, fresh meats, vegetables, and garbage will usually prevent a visit by this critter.

- (2) Snakes - Cottonmouth water moccasins, copper heads, and rattlesnakes are the three varieties of poisonous snakes found in the Northeast. The moccasins are usually found in southern Illinois, Indiana, Ohio, Missouri, and West Virginia. Copperheads are found in the same states as well as Pennsylvania. Rattlesnakes are found in Wisconsin, Minnesota, Iowa, Illinois, Indiana, Ohio, Pennsylvania, New York, West Virginia, and Missouri.
- (3) Diseases - Lymes disease is not fatal, but is a serious concern because of the delayed appearance and the side effects. It is tick borne. Rabies can be a local problem in some areas. Giardia, or beaver fever is present in many of the waters of the northeast.
- (4) Miscellaneous Hazards - Poison ivy and poison sumac are common. In some areas they can be a major problem. Abandoned mine shafts, tunnels, caves, quarries, open pit mines, and exploration holes are present in some areas. Many of these also serve as dens for poisonous snakes.

2. Functional.

a. State Organizations.

- (1) All 20 Northeast States have a forestry program that is a part of a department of: agriculture, conservation, natural resources or environmental protection and all are headed by a state forester. They all have someone who is in charge of their fire program, although the size of that group varies.
- (2) All 20 of the Northeastern States have been exposed to the ICS. Many are operating under the ICS; New York is operating under an all-risk ICS. Some of the states have such a small fire organization it is not possible for them to establish it, although several have trained their employees through the I-420 level and have been able to place personnel on the Area/Region's new Type I team. At least two of the states - Minnesota and Wisconsin have formed interagency ICS groups. Minnesota's has been in existence for several years and is made up of the Minnesota Forestry program. Minnesota Emergency Government, USFS, BIA and NPS. At present they are a fire organization, although they are working toward an all-risk organization. Wisconsin's group is made up of the Department of Natural Resources (primary the fire program), USFS, NPS, BIA, F&WS, BLM, Emergency

Government, State Fire Chiefs, State Sheriff's and Police Chief's Association. Like New York State they are going into an all-risk ICS.

- (3) State involvement with the US Forest Service is in the form of the Cooperative Agreement with the Region, which is usually supplemented by the Annual Operating Plans with the adjacent forests. The Northeast Area is the only part of the USFS system that still has a separate State and Private Organization, which handles the formal relationship. The State and Private office is located in Radnor, Pennsylvania, but maintains fire coordination with the region through the Eastern Coordination Center in Milwaukee. In some states the state agency protects entire districts of the national forests while in other states the Forest Service will protect state lands under "Imbalance Agreements".
- (4) In some states, the state agency provides contract forest fire protection on Indian reservation lands for the Bureau of Indian Affairs or on National Parks or National Park Service lands. There is usually a working relationship with the U.S. Fish and Wildlife Service, and mutual aid agreements exist between the two agencies on some refuges.
- (5) Volunteer fire departments or full-time paid departments may be a planned part of the initial attack organization in some states, or parts of states, and a resource that is called upon when needed in others. Mutual aid agreements are not uncommon. In at least one state the fire control organization is required by law to have structural training for its personnel and to carry equipment that will enable them to do initial attack on structure fires.

As the wildland and the homeowner become closer and closer in their relationship, the tow groups are becoming more and more interrelated in their training and planning. As a result of the Super Fund Amendment and Recovery Act (SARA) all structural fire departments are required to use "an incident command system" in their operations. Because there are various versions out there, make sure you define your terms when using these agencies. Probably the classic example of this is the word "Tanker". To most fire departments a tanker is a truck that hauls water. At best you may get an "aerial tanker", but don't be surprised if it turns out to be a "water bomber".

- (6) Almost all states have organized crews that are a part of the national mobile crew program. In some instances these crews will consist of full-time agency firefighters, while others will be trained personnel who are used by the states in their own program, as well as the national effort. At present, almost all crews come under a two-week limitation with an option to

renew after that time. This is necessary in part because the crewmembers quite often take their vacation from their full-time job to respond to the call. Many of the states are working toward the three-week agreement. If they send employees as part of an interagency crew, this will usually be for the three-week commitment. During the 1994 mobilization three week assignments were the rule rather than the exception. Check with the Crew Liaison Officer or Area Representative on this.

While these crews aren't from the higher elevations found in the West, they do have experience in rough and hilly country, are proficient with hand tools, and in many cases are well qualified in the use of pumps and hoses. If you have a crew from Rhode Island, Connecticut, Maine, or New Hampshire, and your want water moved, these are some of the best you'll find. As budget cuts reduce the number of people any one agency, or even a forest, can send, the interagency crew is becoming more popular. It is not uncommon to find a crew made up of employees of one or two national forests, the Bureau of Indian Affairs, and a state.

b. Equipment.

- (1) The type of equipment used varies according to the state, its fire problem, topography, and budget. Some may be fairly new and modern, while in other cases it may be twenty or thirty years old. Just remember, it may be they all felt they need or can afford their program.
- (2) Hose line and pumps are used in many of the states, either as initial attack tools, or to supplement the hand tools. Engines of various sized and types are used by some of the states. Compressed Air Foam (CAF) or other forms of foam capability are becoming standard on many of the engines in the northeast. Most of the states are now typing their equipment under ICS. During the 1994 mobilization engine task forces and strike teams were sent from several of the northeastern states and from all reports were quite helpful, especially in some of the structural protection assignments. Because not all of these units are configured to carry as many people as the USFS units usually do it is common practice to send them as strike teams which will include their own mechanic support and a van or other vehicle to carry the extra crew members. Usually it is quicker and easier to ship the engines by flat bed truck and fly the crew to the scene. This way you have a fresh crew and a vehicle that are ready to go onto the fire.

For local in state, or adjacent state use, the sending agency will usually drive the unit directly to the scene. Highly specialized equipment, such as the brush breakers used by the fire departments in the Cape Cod area, high flotation tractors like the Bombardier used in Minnesota and Wisconsin,

and the rubber tired skidder of Michigan has been developed or purchased to meet a special need. State such as Michigan and Wisconsin also use crawler tractors with dozer blades and two way plows to meet their needs.

- (3) In Wisconsin, there are equipped out tractors with water tanks and a sprinkler system to protect the operator and provide a means of knocking down a fire if it gets too hot. Afterwards, the water can be used for mop-up. Foam capability has been added to many of the engines.
- (4) The eastern Region Fire Equipment Cache is located in the inter-agency Northern Fire Center at Grand Rapids, Minnesota. It is a part of the National Fire Equipment System (NFS) and is designed and stocked to supply 1,000 firefighters. They publish their own catalog, which lists the suppliers available and gives travel time maps for planning purposes. Any team coming into Minnesota will automatically receive a copy of this document. Copies are also available upon request.

c. Compacts.

As a result of the disastrous fires in New England in the fall of 1946, and the need for the eastern states to be able to help each other without a lot of red tape in an emergency, the Northeastern Forest Fire Protection Commission was formed. This eventually led to Congressional approval of the Northeastern Forest Fire Protection Compact, which enables seven New England states and two Canadian Provinces to exchange manpower and equipment for a major fire problem. Since then the Middle Atlantic Compact and the Great Lakes Forest Fire Compacts have also been formed in the Northeast Area. Although the compacts are used as a means of coordinating training, fire protection, equipment development and purchase, they provide a means of immediate assistance to a member or members in the event of a fire emergency. This is especially important in areas where the agencies have a limited amount of trained overhead and equipment and the fire is of a relatively short duration. The compacts work through the USDA Forest Service's Area Office of State and Private Forestry in calling for assistance from states or agencies outside of the calling compact.

d. Environmental.

- (1) Although the northeast does not have the large wilderness areas common to the west, there are several environmentally sensitive areas that have been designated by state or federal agencies. The timber wolf recovery program, bald eagle nesting sites, and the program to reintroduce rare and endangered species are all considerations. Perhaps a bigger concern will be the air quality programs the various states

have. Pressure to minimize smoke will be great in some parts of the northeast and a team should be prepared to deal with these types of issues. Water quality will be another important factor to be concerned with.

- (2) At the present time fire scene rehabilitation is not a consideration on most state incidents, although it is beginning to become an issue in some cases. Work very closely with your local resource advisor on this matter; also be sure to discuss it with the agency you are taking the incident from.

e. Socio-economic.

- (1) Wood production and wood using industries are the mainstay of many northeastern communities, although tourism has become a very popular dollar generator in recent years.
- (2) Because of the unemployment situation, a readily available of semiskilled and untrained firefighters exists in most states. Be aware of pressure to use these people versus calling crews from outside, especially because of the budget problems.
- (3) Not everyone in the Northeast is concerned about the immediate suppression of all fires. This isn't just the "naturalist" movement, but also some local ethnical situations where fire is felt to be essential to the welfare of game and other things.

f. Political Considerations.

- (1) Almost all of the states in the Northeast are faced with limited fire budgets. Expect severe economic constraints on any incident you are called upon to handle.
- (2) State organizations are limited in size when compared to the federal agencies. Their equipment may be old and out of date, but in many instances it is all they can afford.

g. Mini-summary.

Oak-Hickory is the major fuel type. It is found in all 20 states.

Compacts provide mutual aid and are in place in the east and south. They have been used to provide instant response for major fires in the member states.

III. SPECIFIC FUELS

Unique Fire Situations.

Maine - Maine is the most forested state, on a per acre basis, of any state in the United States. It also has the least public land ownership of any state - less than 2 percent. It has a state fire control organization that is directly or indirectly responsible for all forest fire protection in the state. Over 50 percent of its forest lands are Spruce-Fir type. Fire Behavior Models 4 and 10 best represent this fuel type. Maine has the most lightning fires of any state in the northeast.

New Jersey - Within 35 miles of New York City and Philadelphia rest 1.2 million acres of forest area known as the New Jersey Pine Barrens. It is composed of highly flammable pine types that have a long history of fire. Fire Behavior Model 4 is used for this fuel. Fires in this area occur with regular frequency and cause major damage, loss of property and, in some instances, loss of life. An aggressive, direct attack with the occasional use of backfires is the tactic recommended here.

Pennsylvania - Primary forest type for the Keystone State is Oak-Hickory. Use Fire Behavior Model 8 and 9. Over one million acres of Pennsylvania wild land suffered mortality from the oak leaf roller. In addition, it has been severely damaged by the gypsy moth. The topography of Pennsylvania is some of the more rugged in the Northeast area. The encroachment of second homes into this area has added problems to their suppression efforts.

The Commonwealth uses a limited cadre of their own people who are supplemented by a highly trained force of volunteer fire wardens and trained volunteer crewmembers to do their forest fire suppression work. Tactics in this fuel are aggressive, direct attack, use topography and natural barriers and burn out lines once they are constructed.

A. Lake States Area.

1. Lake States area consists of Minnesota, Wisconsin, and Michigan.
2. Approximately 70 million acres of potential wildfire land.
3. Influenced by 4 of the Great Lakes - Superior, Michigan, Huron, and Erie.
4. Topography.
 - a. From flat to somewhat hilly.
 - b. Elevation from 500 to 2,300 feet.
 - c. Slope - generally not a problem in fire control.

5. Climate and Weather.

- a. Four seasons.
- b. Precipitation - 28 to 32 inches.
- c. Winds - prevailing southwest to west.

6. Fire Season and Fire Conditions.

- a. Normal fire season is April through June, with a second season from mid-September to late October or early November. The crown fire season will usually begin in mid-April and end in late May or early June. Jack pine seems to be most susceptible to crowning when it is pollinating. Drought conditions will extend the crown fire season into late summer and early fall.
- b. Critical weather preceding a crown fire will usually be:
 - (1) Winds from SW to W at 8 - 12 gusting to 25;
 - (2) Temperatures of 65 degrees or more. Above 75 degrees in spring or fall indicate potential problems;
 - (3) Humidity of 30 percent or less. Below 30 percent expect erratic fire behavior and below 20 percent look for things to explode.
 - (4) Fuel moisture of 8 percent or less in the 10-hour sticks and 5 percent or less in the 1-hour readings;
 - (5) Usually occurs during or on the back side of a high pressure area.
- c. Hudson Bay High.

This is the system that will tear you apart before you know what has happened. It begins as a cool Canadian high, which forms over Hudson Bay ice and moves south. It picks up very little moisture over Canada and warms through subsidence. The humidities will drop (10 percent or less in extreme cases), temperatures go up and winds become gusty. Nighttime temperatures may vary as much as 40 degrees. Humidity might not recover. Tendency to stagnate for days. Visibility goes to pieces. At height may be one mile. Is a haze. When it begins to move, winds will shift from E to S-SW-W. Tendency to fishtail. Sign that system is moving! Lake States' forecasters are experienced with this weather pattern and will advise you of it.

B. Problem Fuels.

1. Pine fuels.
2. Muck and peat fuels (Spruce-Bog).

C. Jack Pine.

1. Predominate fuel.
2. Medium to heavy density.
3. Contiguous arrangement of live and slash fuel.
4. One thing to remember about our surface or grass fuels is that they are perennials and do not automatically brown off each summer. They will recover from drought with some rain, and can reduce fire spread in many instances. On the other hand, they will tend to stay green during dry weather and burn quite readily if ignited.

D. Pine Fire Problem.

The major fire problem you could face on a trip "back East" is the crown fire in a Jack Pine or Red Pine area. These are fast burning fires that can run in excess of a mile per hour and be all done in seven or eight hours. Here are some examples:

E. Expected Fire Behavior.

A typical Lake States' Jack Pine fire will be of one day's duration. It may burn up to 15 miles during that period of time. It will normally average about 1 MPH with spotting $\frac{1}{4}$ mile or more in advance of the head. Normal fire run will be until dark or change of fuel type but fires have been known to run through the night.

Mini-summary

Maine has a Spruce-Fir cover type that covers the largest percentage of its forest area. It is Fire Behavior Models 4 & 10. Lightning is their big problem.

In New Jersey, the pine barrens provide some of the fastest burning fuels in the east. It is rated as Behavior Model 4, the same as California Chaparral. A major forest fire with high value property loss is possible within 50 miles of New York City.

Pennsylvania has vast acreages of insect killed or defoliated hardwoods that cause major fires in that area.

Fires are primarily Jack Pine - Red Pine plantations with slash interspersed. Surface fuels cured and one and ten hour readings being very low.

Weather during most critical fire period is characteristically dominated by the Hudson Bay High Pressure.

F. Crown Fire Strategy.

1. Plan for a large fire. Under crown fire conditions a fire can easily reach 1,000 acres in the first hour.
 - a. The Mack Lake Fire of May 5, 1980, had a sustained rate of spread of 2 MPH the first three hours. (176 feet per minute). The next 2 ½ hours it dropped to 1.2 MPH or 100 feet per minute. It burned 24,790 acres in one afternoon.
 - b. Individual runs of 6 MPH or 528 feet per minute have been reported.
2. Work the flanks. Try to pinch or narrow the fire at every opportunity.
3. If you are planning back fire, allow an hour to two hours to carry them out, otherwise spotting will negate your efforts.
4. Plan to control or reduce the head when:
 - a. You get a change in fuel types.
 - b. You get a change in weather conditions.
 - c. Usually nightfall will help you.
5. Control confusion.
6. Do not take defeatist attitude.
7. Maintain awareness of weather conditions.
 - a. Prepare for turning action of fire as front passes.
 - b. Expect spotting to be up to ½ mile ahead of the main fire.
 - c. There are experienced fire weather forecasters in each of the three states. They are familiar with the vagaries of the Hudson Bay High, as well as the influence the Great Lakes have on your fires. **USE THEM.**
8. Remember, land ownership patterns here do not allow the luxury of writing off large acres of government land of back fires or indirect attack. Private land patterns require an effort to protect every acre of land.

9. Resource Deployment.

Most fires are divided into divisions, and if structures are involved, zones early on to facilitate control of the suppression effort.

- a. As you stand at the origin of the fire and look toward the head, the usual deployment of equipment and personnel is 1/4 floating with the head to take advantages of any changes in fuel type, natural barriers, or other events which will help narrow the head. This tactic is used because in almost all cases the fire will be moving from southwest to northeast and will be driven by a wind that will be changing to the northwest as the frontal system passes.
 - b. Many of the local agencies will have designated preplanned zones to handle interface activities. These will be assigned to the structural force under the control of an experienced structural fire person. A rule of thumb for planning and assignment is one structural engine for each structural to be protected for one hour. Needless to say there will be some hard decisions made on what is going to be defended and what will be written off because there usually will not be enough equipment available to go around!
10. Fire control tactics are based on a highly mechanized fire control force backed up by manpower, especially in mop-up. Air tankers and helicopters are usually not available for the first day. In some instances they might not be available at all.
 11. Use equipment effectively, do not waste tractor-plow effort. Do not under estimate the capability.
 12. If fire runs into the night:
 - a. Increase aggressiveness - attempt to control as soon as possible.
 - b. Complete line to secure.
 - c. Do not wait for next day. (Equipment should be equipped for night use.)
 - d. Begin mop-up.
 - e. Plan for release of equipment - next day, another fire.

G. Equipment Assignment - Fire Line Tactics.

1. Tractor-plow Unit.

- a. Will construct line at various rates, depending on cover and fire behavior. Blade is not for line construction but to clear slash and debris for line building.

- b. Tractor-plow should be assigned in tandem if available and should build line as close as safety will allow. Burn out line behind tractor-plow. Use caution - be prepared to yield to fire.

No UNBROKEN LINE behind tractor-plow, PATROL must be maintained. Aircraft surveillance can be utilized but hand tool crews are best. Maintain constant availability of communications. Fire is moving at a relatively fast rate - do not lost control of equipment.

- c. Line placement should utilize all natural openings, skidways, hardwood ridges, or other control or equipment.
- d. Line placement into plantations requires extreme caution and operators must have a planned escape route. Demands highly skilled operators knowledgeable of crown fire behavior. Rapid swings in expanding perimeter line.
- e. Line placement approaching the head of fire on the right flank must be done with extreme caution. A tractor-plow operator may become involved with spot fires and developing head of fire.

Explosive fire conditions - rapid swings of the fire flank are to be expected. Tractor-plow line construction rates for 450 and 350 class tractors allow tractors to overtake fire head.

Actively develop and improve tractor-plow line of a right flank. BE PREPARED to yield if frontal actions turns the fire. All equipment must begin working fire in new direction.

2. Volunteer Fire Departments.

Maintain contact with their equipment. Do not allow the resources to be wasted. Structural fire protection is their key responsibility; however, if a favorable condition is reached, allowing for a stand on a road, hardwood area, etc., the fire department tanker capability can be utilized for pre-wetting and line holding. Many will have extensive wildfire experience but make certain of levels of experience.

H. Modification in Crown Fire Strategy and Tactics.

Michigan - Use same basic strategies and techniques. Some equipment is the same, such as the JD-450 unit, but also use rubber tired skidders with plowers, armored 6x6 tankers with a plow and armored 6x6 tankers to build and hold line. Tanker trucks follow tractor-plow units, do not lead it.

Minnesota - Aircraft used in control of fires. Retardant is used on flanks, primarily to slow the fire spread in order to allow line construction equipment to control fire flank. Retardant drops are not used at the head of a running Jack Pine crown fire. (May be rare exceptions). Basic fire control strategy and tactics are similar to Michigan and Wisconsin.

Are there any questions on the pine crown fire of the Lake States and the equipment or tactics used to fight them?

Summary

Pine fires in the spring can be expected to develop rapidly into crown fires when occurring on very high or extreme fire days. Usually this will be during or preceded by a period of high pressure. The most critical fire weather system is the Hudson Bay High. When the high begins to move, winds will fish tail from SE to S to SW to W. Once started, it is usually very rapid. Crown fires can also occur in the summer or fall if the weather is right. Don't be fooled by the season.

Weather conditions associated with a crown fire are:

1. Winds 12 - 25 MPH and gusty.
2. Temperature 65 degrees or greater.
3. Humidity 30% or less.
4. 10 hour fuel - 8% or less.

Control is based upon rapid deployment of control forces and the strategy will be to keep the fire as narrow as possible. The fire control forces must be always aware of the turning characteristics of fires under influence of high pressure front.

Remember, the most disastrous forest fire ever recorded occurred in October at a place called Peshtigo. We'll now take a break.

IV. MUCK AND PEAT FIRE PROBLEM

This section on muck and peat fire will tell you a little about the organic soils capable of supporting a fire, the problems associated with these fires, and the strategy and tactics required to suppress them.

A. Definition and General Description.

1. Peat is raw and partially decomposed plant remains accumulated under conditions of excessive moisture. For practical purposes, peat soils typically contain a great deal of woody and rooted material and are brownish in color. Muck soils are fine, fully decomposed with a characteristically dark black color.
2. Moisture Retention.

Organic or muck soils hold several times more moisture than mineral soils. The amount of water held is dependent on the type of organic soils and degree of decomposition.

3. Time Period to Produce.

It takes 100 to 500 years to produce a foot-layer of residue. The rate depends upon plant cover and environmental conditions. Depth may be 40 feet or more.

B. Why should peat fires be suppressed?

1. Values.

- a. Farm lands.
- b. Commercial peat and muck producers.
- c. Wetlands.

2. Involvement with highways.

3. Continuing fire control problem will burn time after time.

4. Peat fires are very costly to extinguish, especially for the acreage burned.

5. Peat fires are not a respecter of the calendar. Just because there is snow on the ground, doesn't mean you don't have to take care of burning peat.

6. There is an unseen problem in that the smell is carried in the air long after the visual signs of smoke are gone. Mix this with the fog or smog of Milwaukee, Detroit, Chicago or Minneapolis-St. Paul and you have a definite public relations problem. This tends to make these people extra jittery when they find out it is coming from a fire 200 - 500 miles away.

C. Weather and Peat Fires.

Drought - Unlike the Western States, drought is not an annual occurrence in the Northeast or North Central United States. As I mentioned earlier, our fuels do not automatically die off for lack of moisture. We may go 8-10 years without any serious problem and then get hit for two or three years in a row. One good guide is the Palmer Drought Index. As it starts to build, you can expect peat fires to start occurring. Another good sign is when fires in July and August start running in the green fuels and start to hold over. All of these are indicators of potential peat fire problems.

V. STRATEGY

A. Planning for the control and suppression of a fire involving muck or peat lands will often require planning for two distinct fire problems.

1. Control and mop-up of a surface fire.

2. Control and mop-up of a ground fire. The control and mop-up may require different equipment and manpower to meet the needs of each problem.
3. If a Fire Team is requested to assist in the control and suppression of a muck or peat fire in the Lake States, it should be assumed a severe drought condition exists.

B. Strategy Planning.

1. Control and mop-up of surface fire - fuels.
 - a. Surface fuels involved.
 - (1) Spruce - Bog (patchy).
 - (2) Grass meadow.
 - (3) Spruce, Balsam, Tamarack swamps.
 - (4) Dense brush.
 - (5) Leather Leaf Bog.
 - (6) Farm lands, drained.
 - (7) Aspen - Scrub Oak.
 - b. Size of area involved.
 - c. Depth and condition of muck or peat (affects surface fire control).
 - (1) Accessibility.
 - (2) Water table.
 - (3) Ability to support equipment.
 - (4) Available of water source.
 - (5) Amount and condition of ground fire.
 - d. Values threatened.
 - (1) Farmland.
 - (2) Highways.
 - (3) Homes, subdivision.
 - (4) Other.

2. Attack Plan.

- a. Indirect.
- b. Direct.
- c. Combination of both.

In most cases the attack plan will consist of both direct and indirect attack on portions of the line.

3. Plan to control fire spread as quickly as possible.

- a. Do not intentionally allow seemingly safe areas to burn when peat or muck is involved with a surface fire. To do so may require an expensive mop-up.
- b. Plan to suppress surface fire as quickly as possible and mop-up completely.
- c. Determine how line construction is to be accomplished and equipment and manpower needs.
- d. Determine if fire may spread into adjacent fuels; e.g., Jack Pine, Spruce or other problem fuels (drought condition - will affect manpower and equipment needs and strategy to control).
- e. Determine if fire may become involved with high value farm lands.

4. Do not underestimate problems.

- a. Fire involving muck and peat require a great deal of initiative and adapting of equipment to meet needs.
- b. Set up equipment maintenance program. Muck and peat fires raise havoc with equipment.

5. Set up and monitor safety program.

- a. Injuries to firefighters.

Safety – It is extremely important that proper training and clothing be provided to crews assigned to control and mop-up of muck and peat fires.

(1) Wearing apparel.

- (a) Helmets.
- (b) Gloves.
- (c) Goggles.

- (d) Face masks (dust).
- (e) Snug fitting coveralls.
- (2) Foot gear.
 - (a) Laced 10" boots.
 - (b) Rubber boots.
 - (c) "Bean" boots.
- (3) Do not allow other types of boots. Stepping into hot burning peat or muck could result in severe burns.
- (4) Common injuries.
 - (a) Eyes - dust and blowing ash.
 - (b) Falling material - trees burned off at the roots. No warning.
 - (c) Tripping.
 - (d) Burns.
 - (e) Typical injury prone area.
- b. Involvement with highways (smoke).

It is well to remember in developing your strategy for a fire involving peat or muck that you are only part way home when the surface fire is brought under control.

Effective mop-up is your most important and difficult assignment.

The fire is probably burning under drought conditions.

Surface fuels will affect the tactics applied in the control and suppression of the fire.

C. Construction of Fire Lines.

1. Lines must be constructed to mineral soil or below water table.
2. Care must be used in constructing lines with tractor-plows or bulldozers when working over peat or muck. You will probably be only able to make one pass. After vegetation and material supporting the tractor has been disturbed, any further action may result in getting the unit stuck. Wide tracks (36+ pads) are available from private sources for hire.

3. Lines constructed through peat or muck that do not reach mineral soil or the water table should not be depended on to hold the fire. They will normally restrict the fire for 24 hours. After that, either new lines must be constructed or plow lines wet down.
4. When constructing lines through peat or muck, do not push material onto the fire side. To do so will result in a difficult and costly suppression problem.
5. Equipment used in line construction.
 - a. Plowing.
 - b. Bulldozing.
 - c. Hand crews.
 - d. Line to mineral soil - shallow peat.
 - e. Trenching, backhoes, etc.
 - f. Blasting.
 - g. Drag line, etc.

D. Suppression of Muck and Peat Fires.

1. Suppression of muck and peat fires using water.

Water – The use of water is effective, when available in an unlimited supply, or at least sufficient to meet suppression needs.

- a. Effective on large fires or where dense surface fuels are present.

May be necessary to pump long distance.
- b. Requires manpower and equipment to set up and operate.
- c. Pumping equipment, irrigation pipe and specialized hoses are required.
- d. Difficult to deploy through downed material.
- e. Require continuous operation to be effective.
 - (1) May require pumping for weeks or even months.
 - (2) Equipment must be moved every 6 - 10 hours.
 - (3) Sprinkler system must overlap.
 - (4) Becomes a mess.

- (5) Care must be used to not lay hose over burning peat or muck.
- (6) When pumping from sources near fire, beware of water table and influences on fire.
- (7) If water sources are moving, will probably support pumping.
- f. Water sources may be several miles from fire. Do not let this restrict you.

The use of water in suppressing muck and peat fires is usually an experience and time-consuming task. On large fires or where dense surface fuels are present, water is the only practical means of suppression.

It may be necessary to pump water for weeks or even months. Large quantities of water must then be available.

- 2. Suppression of muck and peat fires using dry methods or combination of water and dry.

The dry methods of suppressing a muck or peat fire is usually less costly and will require less time and manpower to suppress.

- a. Blading - to mix and cool material-effective on areas where surface will allow. Mixing of burning material with cool, damp heat will suppress the burning material.
- b. Disking - breaking up surface material and mixing unburned, cool, damp peat. Disking is effective where fire has not burned down into past or muck. Particularly effective on drained farm land. Begin immediately.

E. Mop-up.

Probably one of the dirtiest jobs that a fire suppression team will encounter is the mop-up of a muck or peat fire.

- 1. Do not depend on rain or snow to suppress a muck or peat fire.
 - a. Muck and peat fires have been known to burn for months and through northern winter. In the spring, the fire has come alive and began to spread on the surface.
 - b. The State of Minnesota, in the fall of 1976, had over 20,000 acres of muck and peat to suppress.
- 2. Locating burning material.
 - a. Early in morning - often smoke or steam will show. During heat of the day difficult to locate.

- b. Nose - distinctive odor from burning material - develop a sensitive nose.
 - c. Search for by hand - be careful.
 - d. Infrared scanners - from helicopter.
 - e. Hand-held infrared scanners. Effective in the morning before heating by sun.
 - f. All hot spots located must be flagged for mop-up.
 - (1) Effective locating of hot spots will reduce the cost and work required to suppress.
 - (2) Effective hot spot locating will reduce the number of passes by equipment.
 - g. Dig them out - mop them up.
3. A peat or muck fire is an extremely destructive fire and will not go out as long as there is organic soil to sustain the fire. It must be suppressed.

VI. SUMMARY

If an Incident Management Team is coming to the Northeast the following is extremely important:

- A. Obtain a qualified state resource person to advise you on fire weather, fire behavior, and local situations.
- B. Try to get a person knowledgeable of local fire weather conditions, preferably a trained fire behavior officer.
- C. Use the local fire weather forecaster for your forecasts.
- D. Be sensitive to the local state organization and its problem; establish a liaison with the agency responsible for forest fire control anytime that a fire threatens to involve the other agency's protection area. The sooner the better.
- E. The key problems apparent to a team reporting into the northeast are:
 - 1. The variety of state governmental agencies.
 - 2. The variety of fire suppression organizations.
 - 3. The wide geographic area with the resulting wide range of fuels and fire conditions.