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DEPARTMENT of NATURAL RESOURCES

1987-89 BIENNIAL BUDGET
BASE LEVEL REVIEW

WILDFIRE PROTECTION PROGRAM

NOVEMBER 1986

1987 - 1989 BIENNIAL BUDGET

BASE LEVEL REVIEW

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF FORESTRY

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MINNESOTA DEPARTMENT OF NATURAL RESOURCES

DIVISION OF FORESTRY

WILDFIRE PROTECTION

EXECUTIVE SUMMARY

Wildfire protection is a basic public safety service that has been provided by the Division of Forestry for more than 75 years.

By statute, the Department of Natural Resources is charged with preventing and suppressing wildfire on public and private land in the forested counties of Minnesota. This includes all but 13 counties in the southwest. Direct suppression action is provided on 22.8 million acres.

The goal of this program is to provide the level of protection necessary to avoid loss of life and to minimize losses to property and natural resource values. Standards to address values at risk are contained in administrative fire plans.

Delivery of the service is provided through an organization, that continues to evolve, for the purpose of providing a mix of wildland fire protection, state land management and other public services related to forest resources. The basic fire protection organization is pyramidal in structure with overall program direction provided by a central staff. Wildfire protection is delivered by a network of field stations and a statewide wildfire control and coordination center. Direct suppression is provided by field office personnel. The control center administers and dispatches resources which are used statewide such as airtankers, helicopters and fire cache equipment.

Minnesota has a history of large and destructive forest fires. These fires have resulted in the loss of hundreds of lives, human suffering and destruction of property and natural resources. This same potential exists today. As recently as 1980, towns would have been destroyed without the suppression action provided for by the DNR. The development of homes and properties in rural and semi-rural areas, has made the protection of structures a normal circumstance in the DNR's wildfire suppression.

Wildfire protection is divided into prevention, presuppression and suppression functions. Prevention is designed to reduce the number of fires and losses through public education, regulation of open burning and law enforcement. Presuppression prepares suppression forces for the eventuality of fire and provides for the maximum speed in detection of fires. Activities include training, establishment of inter- and intrastate mutual aid agreements, development of local and statewide plans and dispatching procedures, methods to organizationally cope with large, escaped fires, and monitoring weather and its related fire danger. Suppression is the extinguishment of fires at the minimum possible size, in the shortest time possible, considering values at risk. This is accomplished through a balanced application of suppression forces including trained crews, crawler tractor and plow units, dozers, fire trucks, pumps and hose, hand tools airtankers, fire retardants, and

helicopters equipped for cascading water. Operations are often jointly accomplished with fire departments and sometimes with federal agencies.

Direct fire presuppression and suppression funding is contained in the Fire Fighting Activity. Personnel, fuel, supplies, and communications are part on the division's Forest Management Activity. Fire Protection is directly affected by department equipment, maintenance, Information and Education budgets, as well as other appropriations. Three federal programs influence the delivery of protection services.

Funding of wildfire protection is reaching a critical point. The Fire Fighting Activity is of concern, as are funds contained in several other budgets that impact fire protection. The base level review suggests that the exploration of other sources of funding be considered. The review proposes that it may be appropriate to protect funds which provide for public safety from non-legislative budget reductions.

The Legislative Commission on Minnesota Resources sponsored an economic analysis of the wildfire protection activity. The study, which used a National system, was developed by the United States Forest Service and based on the least cost plus loss principal. The results of the analysis show that Minnesota's program requires additional presuppression funding to achieve peak economic efficiency. The most cost efficient level of fire protection would occur with a 14% increase in presuppression funding over 1982 levels. This amounts to an increase of $1,295,000 in presuppression funding. The net result of this increase would be an average 29% decrease in total expenditures and damages. Conversely, if funding were decreased by 14%, total expenditures and damages are predicted to increase on average by 62%. Total acres burned would increase by 120%.

Effective wildfire protection benefits almost every facet of the social and economic life in Minnesota. Wildfire directly impacts two of the three major industries in the forested areas, timber and tourism.

The department's ally in providing wildfire protection is Minnesota's rural fire departments. Fire departments are examined as an alternative to the present method of providing wildfire protection. The review process indicates why this is not a practical alternative. It also points out that increased inputs and cooperation by both allies would provide dividends. This is particularly true in prevention efforts.

In its conclusion the base level review indicates areas that need to be considered for program improvement in order to achieve the most efficient level of protection. Program improvement is suggested in fire prevention through cooperation with rural fire departments, encouragement of local authorities to provide zoning and encouragement of insurance companies to take steps to minimize losses. The ability to continue fire planning efforts, increases in fire law enforcement, and quality of weather forecasts are additional areas for improvement.

Ground fire equipment is a major area of concern. Funding for improvement of this equipment is contained in a DNR equipment change level request. The situation with specialized fire crews is discussed along with levels of funding in the Fire Fighting Activity and concerns over contingency funds. Needs for additional staffing to provide program improvements are expressed.

BASE LEVEL REVIEW
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FORESTRY FIRE PROTECTION PROGRAM

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NOVEMBER, 1986

BASE LEVEL REVIEW
FISCAL YEAR 1987 - 1989

AGENCY: DEPARTMENT OF NATURAL RESOURCES

PROGRAM/ACTIVITY: FOREST MANAGEMENT - FOREST FIRE FIGHTING

INTRODUCTION

In the United States, wildfire protection is one of the basic public safety services government provides. It is provided at the federal, state and local levels. The federal government is restricted to protecting federal lands. State governments provide wildfire protection on public and private lands.

In Minnesota, the Department of Natural Resources is required, by statute (Minnesota Statutes, Chapter 88), to provide wildfire prevention and suppression in the "forested" counties of Minnesota (M.S.88.01) (Appendix IV).

This report will discuss legislation, related programs, division organization and funding, components of the wildfire protection program, and results of an LCMR (Legislative Commission on Minnesota's Resources) economic evaluation of wildfire protection. Problems in program efficiency and effectiveness will be summarized and suggestions for program improvement discussed.

PROGRAM GOAL

The goal of the DNR's wildfire protection program is to provide the level of protection necessary to reduce the risk of loss of life and personal injury and, considering values at risk, to minimize losses to property and natural resources on public and private land.

LEGISLATION

Article XI of the State Constitution acknowledges forest fire protection and its need for funding. Minnesota Statutes, Chapter 88, Sections 88.01 to 88.22. charges the Division of Forestry with preventing and extinguishing forest fires. These same statutes recognize the need and grant authority to regulate activities such as open burning.

ORGANIZATION OF THE DIVISION OF FORESTRY

The Minnesota Forest Service was created by the State Legislature in 1911 following several devasting fires in the late 1890's and early 1900's. These fires destroyed the towns of Hinckley, Chisholm, Baudette and Spooner and took over 500 lives. For the first 20 years of its existence, the Minnesota Forest Service was strictly a fire prevention and suppression organization. In 1931, the Legislature created the Department of Conservation, and the Minnesota Forest Service was

renamed the Division of Forestry. Along with the new name the Division of Forestry became multi-functional with the principle responsibilities of fire protection, timber sale administration on State lands and nursery stock production for reforestation of State-owned land.

Today the Division of Forestry is still organized into three major programs: (1) the wildfire protection program, (2) the State land management program, and (3) the cooperative forestry program. The organization consists of a central staff, with personnel located in St. Paul and Grand Rapids, four regional offices, 19 area offices which report to their respective regions and 73 districts each of which report to an area (Appendices I and II). The total legislatively authorized personnel complement for the division is 403.

Each of the regions, areas and districts are delegated certain responsibilities and authorities that pertain to each of the programs within the division. In the case of wildfire protection, each district is responsible for fire prevention, presuppression and initial attack suppression within its geographical boundaries. The area office provides administrative and technical assistance to its districts. The areas also deploy district and area personnel and equipment to meet peak wildfire suppression demands. The functions of the regional offices are of a similar nature to the area, only over a larger geographic area and a considerably larger number of personnel and equipment. Regions are expected to monitor area fire activity, correct problems which are of concern and request statewide assistance from the central staff when necessary.

The wildfire protection section of the division's central staff is administered by an assistant to the director of forestry. Personnel for this section are located in St. Paul and Grand Rapids. The section functions with a broad range of departmental and division authorities to meet emergency situations (Appendix III). In addition to administrative responsibilities, the section oversees several suppression functions and facilities for which efficiency dictates statewide utilization. These include such items as helicopter and airtanker dispatching, fire equipment cache dispatching and other program facets. Because of the limited number of section personnel available to complete the assigned duties, some area personnel have been assigned specific areas of statewide fire coordination under the direction of section staff. The section also relies on departmental expertise in several phases of fire protection. This includes fiscal and information functions, equipment repair facilities, procurement and personnel expertise. During extreme situations, the section, through the Division of Emergency Services, can call upon other State agencies and the National Guard for assistance.

MINNESOTA'S WILDFIRE SITUATION

The Minnesota Department of Natural Resources has primary responsibility for wildfire protection on 22.8 million acres of public and private land. The DNR's total responsibility encompasses 45.5 million acres or 89% of the total land base. This does not include 13 counties in southwestern Minnesota which are considered unforested by Minnesota Statute definition (Appendix IV). On average, the DNR takes action on over 1500 wildfires which burn some 60,000 acres annually. Even with the changes in land use and development which have occurred over the

past century, the potential for losses of life and property as a result of wildfires are greater now than in the past. This is a result of population growth, increased development and the increasing movement of the State's population to rural and semi- rural areas. This demographic change has been given the label of "rural/urban interface". It describes development of populations and associated values in areas that are subject to wildfire losses.

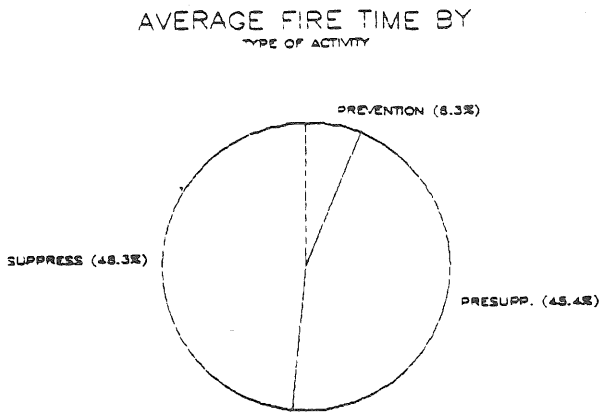
Because of this trend towards increasing urbanization of rural America, there is a growing risk of major wildfire damages. For example, in 1963, a 6,500 acre brush fire destroyed 100 homes on Staten Island in New York. In 1976, Minnesota's Badoura fire burned 23,000 acres and a dozen buildings in just 6 hours. In 1980, the Mack Lake fire in Michigan burned 24,000 acres and 44 structures, also in just 6 hours. In Minnesota, the 1980 Motley fire burned 6,800 acres, destroyed over 20 structures and endangered the towns of Motley and Philbrook. In that same year, two fires in Wisconsin consumed 15,000 acres and 200 structures; both fires lasted for just a few hours. Other examples could be given, but the point is that large and disastrous fires are not a thing of the past.

People cause over 99% of the wildfires the Division of Forestry responds to every year. This means areas with a higher population density have a higher average fire occurrence. As a result of the rural/urban interface, there are now few places where wildland fires don't have the potential to destroy homes and endanger lives. In the past, the protection of structures was an occasional consideration. Today it is a common situation for the division's suppression forces to protect structures before, or in conjunction with, halting the advance of the fire front. Without proper suppression many of these fires would destroy property and endanger lives.

The wildfire suppression organization developed by the Division of Forestry over the past 75 years has, for the most part, been very successful. This very success can be a danger. When fires of major proportions are not experienced on a regular basis, complacency tends to develop. This could lead to future disasters. A fire organization must maintain a base level of preparedness, that can efficiently and effectively be expanded upon to meet the peak demands of an extreme year.

COMPONENTS OF WILDFIRE PROTECTION PROGRAM

The Division of Forestry's wildfire protection program is separated into three activities: (1) wildfire prevention, (2) wildfire presuppression, and (3) wildfire suppression. A majority of the division's personnel time devoted to fire activities is spent on presuppression (45.3%) and suppression (48.4%). The remaining 6.3% of the fire time is spent on prevention activities (Figure 1). The percentage of time devoted to each of these activities and to the fire program in general is a function of the severity of the fire year (Figure 2). Each of these activities will be examined separately so that an overall picture of the fire protection program can be obtained (Appendix V).



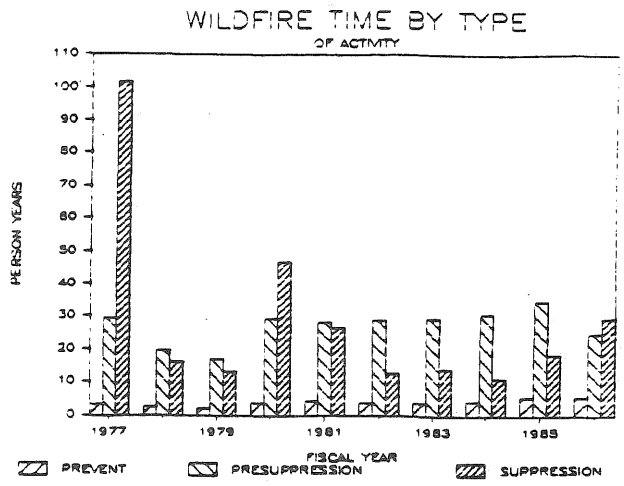


Figure 1

Figure 2

Wildfire Prevention

Fire prevention activities are aimed at reducing the number or frequency of wildfires, and losses. Over 99% of the wildfires in Minnesota are either deliberately or accidentally caused by man (Figure 3) (Appendix VI). However, only 6.3% of the time spent on fire-related activities is currently devoted to prevention. For this reason, fire prevention presents opportunities for reducing the threat of losses from wildfire.

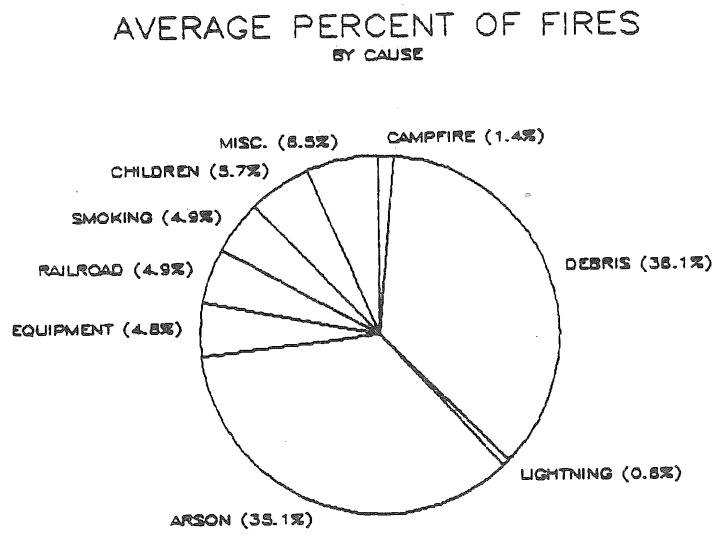


Figure 3

Prevention to date has emphasized public education, burning regulations and law enforcement. The major public education effort has been in the elementary schools using "Smokey the Bear" appearances and materials. In

addition, public service announcements are distributed to print and broadcast media. These announcements provide information to property owners and outdoor recreationists on burning regulations and methods.

Burning regulations contained in Minnesota Statutes, Section 88.17, have been the backbone of the division's fire prevention program since 1925. This law regulates open burning through a permit system. Over 70,000 burning permits are issued annually by Division of Forestry forest officers and a network of 2300 township fire wardens. These wardens provide a valuable fire prevention service to the state on a purely voluntary basis.

Arson is the cause of over 35% of the wildfires in Minnesota. Apprehension and successful prosecution of those responsible is one important weapon in the fight against arson. The Division of Forestry and the Division of Enforcement have established nine arson investigation teams. Each consists of Forest and Conservation Officers who have been trained in fire investigation and fire behavior characteristics.

Collection of fire suppression costs is another method of increasing public awareness about wildfire. Over the past several years, efforts have been increased to identify the parties responsible for wildfires. These parties are then billed for the suppression costs of the fire (M.S.88.75). Reductions in personnel time and funding have a direct reflection on the division's ability to recapture these expenses.

Prevention has been identified as an area of concern not only in Minnesota, but also in the whole Lake States region. Through fire prevention compacts and cooperative agreements progress is being made with federal agencies and other states in developing and coordinating prevention activities.

The division is considering several items that could help to reduce wildfire occurrence and limit wildfire damage. These include the following:

1. A fire prone property program that includes specifications for reducing hazards to property owners should be established. Specifications could include proximity to flammable materials, access road widths and construction materials. A voluntary inspection program for homeowners could be carried out in conjunction with local fire departments.

2. Local units of government should be encouraged to adopt stricter zoning codes. This would carry the fire prone property program one step further by requiring certain safety measures be adopted during home construction.

3. Insurance providers should be informed of potential changes and methods which homeowners could use to reduce wildfire losses.

4. Existing burning regulations should be more strictly enforced.

5. Public education efforts should be improved by targeting prevention messages to specific audiences.

6. A fuels management program should be developed which would identify high hazard areas and provide a means of fuels modification.

Due to the limited amount of staff time and budgets available for prevention projects, little headway has been made on further development or inclusion of these items in the current prevention program.

Wildfire Presuppression

Presuppression action is undertaken before a fire occurs to ensure safe and effective fire control actions. The goal of presuppression is to prepare the firefighting organization to cope with an average fire situation. Of course, not every fire situation is average so the organization must develop the necessary plans and expertise to deal with extreme situations.

Presuppression activities include such specifics as employee and cooperator training, fire planning, fire weather evaluation, fire detection, DNR equipment readiness, inter-agency cooperative agreements, and private equipment agreements.

Within the division, personnel training is a major presuppression activity. Proper training ensures that a safe, effective fire organization can be developed and maintained. Employees must be trained in proper fireline building techniques, water handling, use of aerial suppression forces, and large fire organization and management techniques. In addition to its own employees the division spends considerable time training rural fire departments on wildfire suppression techniques. Rural fire departments, for the most part, are staffed by volunteers so training is a continuing activity. Available time and funding are factors which limit the division's ability to provide the proper training.

The division has been able to expand its training abilities through participation in the Great Lakes Forest Fire Compact. This compact is made up of natural resource agencies from Minnesota, Wisconsin, Michigan, Ontario and soon Manitoba. The objective of the compact is to allow the sharing of suppression resources, training capabilities and fire prevention activities so that mutual savings and increased effectiveness can be realized.

In addition to cooperating with other states, Minnesota cooperates with federal agencies such as the U.S. Forest Service, National Park Service, Bureau of Indian Affairs and the U.S. Fish and Wildlife Service using the Minnesota Incident Command System (MNICS). MNICS is Minnesota's application of the National Interagency Incident Management System (NIIMS). The participation of the Division of Forestry in this system has allowed for standardized wildfire training, experience requirements, terminology, and physical fitness requirements. MNICS allows state and federal agencies to share equipment resources, personnel and knowledge. This system provides a cost savings to the Division of Forestry through the sharing of programs, and expands the division's ability to deal with extreme fire situations.

Another important part of the presuppression effort is the fire planning process. Fire history is examined to determine wildfire causes, ignition patterns, travel routes and times, available suppression resource locations and aerial and fixed detection plans. The division uses this information to develop work schedules, dispatch systems, aerial detection routes, private equipment standby needs and times, and state-owned fire suppression equipment needs (Appendix VII). Each area fire plan establishes presuppression goals and suppression priorities commensurate with the values at risk from wildfire. The fire planning program was begun using funding provided by the Legislative Commission on Minnesota Resources. A considerable amount of time and money was invested over a four year period to develop individual administrative fire plans and maps. At present, the division does not have the resources to keep the plans current. Without continual updating, the fire plans will be of minimal value in the future.

Weather conditions play a major role in fire occurrence and behavior. For this reason, forestry offices operate and maintain weather stations as part of their presuppression duties. Weather data is collected by the areas on a daily basis. This data is input into a U.S. Forest Service computer which uses the National Fire Danger Rating System (NFDRS) to determine daily and forecasted fire danger indices. The indices are combined with specially tailored fire weather forecasts from the National Weather Service to develop short range guidelines for scheduling detection, equipment standby and personnel. Unfortunately, federal budget reductions have forced the National Weather Service to scale down its forecast areas and it is possible that this important service could be eliminated completely.

Wildfire detection plays an important role in presuppression. Discovering and locating a fire as soon as possible after ignition helps to minimize suppression costs and losses. Detection is accomplished by DNR lookout towers, aerial detection or public reporting. Lookout towers, for many years, were the mainstay of wildfire detection. As with other natural resource agencies, the division's lookout tower system has been gradually replaced with organized aerial detection. Some towers are still used and in specific cases offer some advantages over aerial detection. Aerial detection is conducted by small, privately owned aircraft which are contracted on an annual basis. These aircraft are equipped with Division of Forestry radios and an aerial observer, if conditions necessitate. The aircraft follow predetermined flight routes. The activation of these aircraft and the frequency of flight is determined by the existing fire danger. When located, a fire is reported to a division dispatcher. Additional information on the size of the fire, structures endangered, fuel types, and accessibility is also relayed. Having this information available during the initial dispatch is one of the major advantages of aerial detection.

The DNR owns and maintains a majority of the initial attack ground equipment used in wildfire suppression. The equipment is located at area and district offices throughout the state. It includes initial response units, bulldozers, tractor plow units, bombardiers and water tankers. Much of this equipment can be used on other forestry projects when there is no threat of wildfires. As part of the presuppression effort, the equipment is modified for fire use with the addition of

watertanks, pumps, hose, hand tools and other implements. The department also maintains emergency wildfire equipment caches in Grand Rapids and St. Paul (Appendix VIII). Each cache contains handtools, portable pumps, chainsaws, hose, and other safety equipment. The cache items are made available for large project fires and prolonged suppression efforts.

While the DNR owns and maintains a sizable fleet of specialized fire equipment, it still must rely heavily on the equipment available from fire departments, private contractors, and other natural resource agencies. Agreements are drawn up with over 700 of these cooperators on an annual basis. These agreements outline the equipment available to the DNR (e.g. crawler tractors, dozers, pumps, specialized trucks, aircraft). The agreements establish the rate the DNR will pay to operate the equipment on a fire or to have it available to fight a fire. When conditions dictate, equipment is placed on standby so that it is available for fire suppression within a specified time frame. The more specific the time frame, the larger the cost. Funds expended for private equipment standby are mounting as state-owned equipment is not replaced. For certain types of equipment this may be cost efficient, for others it is not. This especially true in some highly specialized items such as bombardiers.

The contracting of private airtankers and helicopters is another part of annual presuppression arrangements. Airtankers are large multi-engine aircraft that can carry 1,000 to 2,000 gallons of fire retardant. These are generally older military planes that have been converted for fire-fighting use. The airtankers used by the DNR are part of a national contract developed by the United States Office of Aircraft Services (OAS). Prior to coming on station in Minnesota they are on fire duty in the southeastern United States and subsequently they are moved to one of the western states. This method of contracting results in considerable cost savings. Aircraft are bid on a daily availability basis, with the flight rates being established by OAS. Two airtankers are paid for by the DNR. The Bureau of Indian Affairs pays for a third. They are stationed at various airtanker bases in northern Minnesota (Appendix VIII). The DNR maintains bases at Brainerd and Hibbing, the Bureau of Indian Affairs and the DNR jointly maintain a base at Bemidji and the U.S. Forest Service maintains one at Ely. The DNR provides airtanker availability to the U.S. Forest Service; however, they pay for flight time and retardant when airtankers are used on Forest Service fires.

Congressional legislation only authorizes the U.S. Forest Service to protect federal lands. In Minnesota, the Forest Service protects almost one million acres of State and private land within the National Forest boundaries for which they are not compensated by the DNR. The DNR is able to reduce 200,000 acres of this imbalance by providing airtanker availability.

Six private helicopters are contracted for and located in various sites in northern Minnesota (Appendix VIII). Contracting is done by the State with the daily availability rate being bid and the hourly flight rate established by the DNR. Each of these machines is equipped to carry a

water bucket for direct suppression. They are also equipped to "sling load" equipment and supplies into remote fire areas. Each machine carries from 1 to 4 firefighters who can begin initial attack on the fire prior to the helicopter starting water drops.

The Division of Forestry also maintains a cooperative agreement with the U.S. Forest Service's National Office as part of the presuppression process. This is the only cost effective method the division has to cope with a severe fire season or a major individual fire. The U.S. Forest Service has the ability to coordinate or provide firefighting resources on a national basis such as equipment from the National Fire Cache in Boise, Idaho, crews from federal agencies and other states, overhead and specialized personnel. All personnel are trained to national standards. It is through this agreement that the Division of Forestry supplies crews and personnel with special qualifications to other states and to federal agencies outside of Minnesota.

Wildfire Suppression

The goal of wildfire suppression is to safely extinguish wildfires without loss of life and with minimal losses to property and natural resource values. Values at risk must be considered when suppression actions are undertaken. The Department of Natural Resources has attempted to provide a balanced mix of suppression tools and expertise that can be expanded upon during periods of unusual fire activity. If that is not accomplished, the costs of an extended fire situation could be staggering.

During an average year the Division of Forestry will respond to over 1500 fires that burn an average of 60,000 acres. On an annual basis, the number of fires and acres burned fluctuates widely (Figure 4, Figure 5). To account for this wide variation, the division must maintain a suppression organization that is prepared for various fire situations.

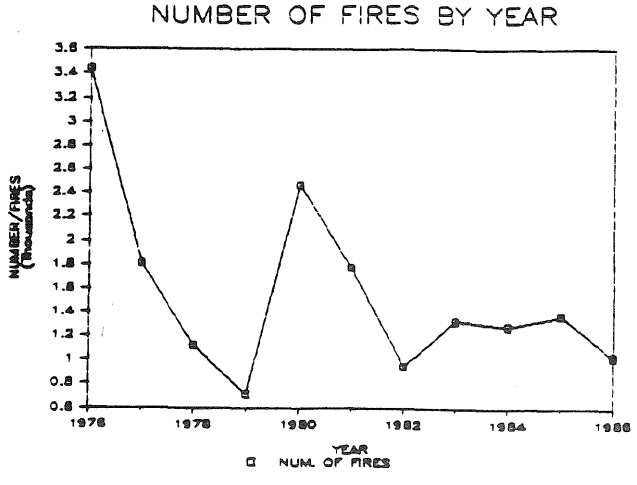


Figure 4

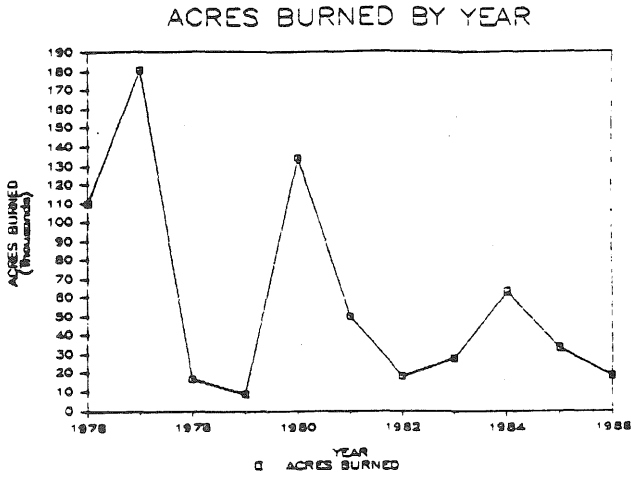


Figure 5

Suppression resources can be classed into broad catagories of ground, aerial, firefighter and organizational resources. Individual fires may require one or more of these resources.

Local dispatching of firefighting equipment takes place at either the District or Area level. A two-way radio system is in place so that firefighters can be dispatched to a fire from any point in the Area. The principle initial attack unit dispatched is a four wheel drive truck with a 200 gallon water tank, pump, hose and hand tools. These units respond with an incident commander (fire boss) and one to two additional firefighters on board.

Most suppression duties are carried out by regular employees of the Division of Forestry. Statutes also authorize the use of temporary employees under emergency conditions. These individuals are used as firefighters, towermen, dispatchers, and special equipment operators. The number of people hired is dependent on the fire danger indices for that day. Prior to budget reductions, the division also employed two, twenty person seasonal firefighting crews. Reductions in the firefighting fund and in project funds forced the lay off of these crews. The division must now obtain crews through its cooperative agreements with other agencies.

After initial evaluation of the fire by the incident commander or detection aircraft, additional state or cooperator resources may be called. Fire departments are a common source of assistance to the DNR in suppressing wildfires. The use of fire departments must be coordinated in such a manner as to minimize the time they are at the scene and maximize the use of their manpower and specialized equipment. There are, however, limitations in their use. Fire department coverage does not extend to all parts of Minnesota. The first priority of fire departments is to protect structures so their ability to suppress wildfires is restricted. In addition, many of the fire departments are not equipped to fight fires in off road situations.

In addition to the ground forces, two other initial attack resources are the helicopter and airtanker suppression systems. These aerial systems are one of the major components in Minnesota's wildfire strategy.

Airtankers are used to apply a retardant material just in front of a running wildfire to halt or slow the advance of the fire. This allows ground forces to be moved in to control the fire. Airtanker dispatching is done on a statewide basis and is the responsibility of the DNR Wildfire Control Center (Appendix VIII). Tankers can be dispatched to fires under the jurisdiction of the DNR, U.S. Forest Service, National Park Service and Bureau of Indian Affairs. The DNR responds to a far greater number of wildfires than any of the other agencies; therefore, a majority of airtanker dispatches are on state fires. Dispatch priority is based on life, property and natural resource values at risk. Airtankers can be prepositioned at each of the different tanker bases (Appendix VIII) depending on fire occurrence patterns at the time. The responsible agency pays for flight time and other costs associated with the specific fire that is attacked.

Helicopters are the second main arm of the aerial wildfire suppression force. Helicopters can be dispatched by individual area foresters within a 50 to 75 mile radius of the helicopter's location. Requests

for a helicopter outside of that range are referred to the Wildfire Control Center. The tactics involved in helicopter use are considerably different from airtankers. The helicopters carry water in "buckets" suspended on cables under the machine. The buckets, which contain up to 150 gallons of water, are refilled by dipping water from lakes, ponds or other water sources. Fire retardant is not used, therefore the fire is attacked directly. Each helicopter has a Division of Forestry helitak foreman assigned to it to direct its suppression action. A few of the machines will also transport a fire crew of three to the fire. These firefighters are transported to the site and left on the ground to commence hand operations while the aircraft starts water operations.

Fixed wing aircraft, whether they are DNR owned or leased from private contractors, provide the means for specialized air coordination as well as the expedient movement of men and materials during periods of high fire danger. Because of the special radio equipment and pilot and air crew experience required, only DNR aircraft are used to coordinate air suppression activities.

When weather conditions result in increased fire activity, management at the region and statewide levels must anticipate the need for rapid mobilization of statewide suppression resources. Mobilization relies heavily upon its cooperative agreements with other natural resource agencies and private contractors. Private contractors are used extensively to provide equipment such as crawler tractors, irrigation systems, and equipment and personnel transport units. The DNR and U.S. Forest Service wildfire equipment cache systems are used to provide the more specialized equipment. Manpower from the local community is used during the initial stages of large fires while organized units of trained crews and specialists are brought in for the more difficult or prolonged suppression efforts.

A major wildfire can involve hundreds or thousands of personnel and many hundreds of pieces of equipment. Administration on large fires requires the use of "overhead teams" to provide the logistics and organization for suppression operations. The use of these teams frees the area and district personnel from responsibility for large fire suppression and allows them to respond to new or smaller fires within their boundaries. Overhead teams and individual large fire specialists are available in Minnesota through the Minnesota Incident Command System (MNICS). Under this system, the Department of Natural Resources, U.S. Forest Service, National Park Service, Bureau of Indian Affairs and the U.S. Fish and Wildlife Service have combined selected highly trained individuals into teams that can be called upon, when needed, to provide organization and strategy for large fire operations.

The rationale behind the MNICS system is that no single agency or state can maintain the level of equipment or personnel resources necessary to support an extreme fire situation. The Division of Forestry's participation in this system has resulted in a tremendous savings in man hours and equipment dollars. There is a danger, however, that the division or any of the other members of MNICS may become too dependent on the system and thereby reduce its own level of preparedness that must be maintained for initial attack responses.

FUNDING

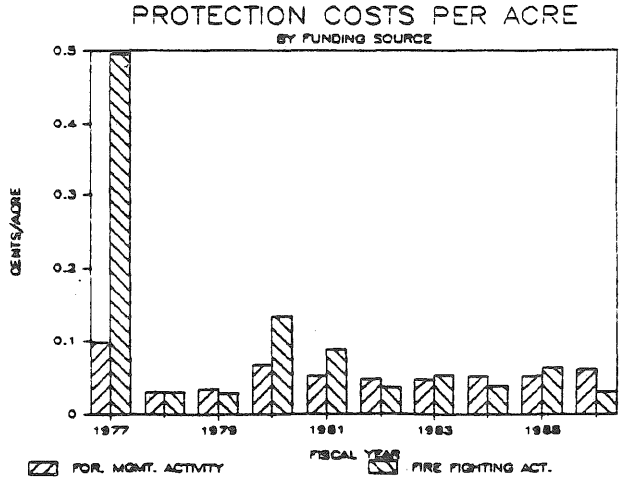
Existing Sources and Levels

Wildfire protection is an integral part of the Division of Forestry's activities. The interweaving of duties is reflected in the existing budget structure. Funds for wildfire protection are located in both the Forest Management Activity and the Fire Fighting Activity.

The division's Forest Management Activity provides multi-activity funding for permanent personnel, communications, repairs, fuel and many other items. The budget in FY 1986 was $10.8 million. In FY 1986, 13.1 percent of the division's time was spent on fire related activities. Applying this percentage, a total of $1.4 million was expended on the various phases of wildfire protection from this fund. This amounts to an average of six cents per acre protected. This figure will fluctuate by the severity of the fire year (Figure 6) (Appendix IX). Fiscal year 1987 expenditures, given an average fire year, can be expected to be approximately $1.4 million.

The division's fire suppression activities are highly dependent upon coordination with other governmental agencies and the private sector. The Fire Fighting Activity is designed to provide a base source of funds to meet these needs. The legislature has recognized that a certain level of advanced contracting for airtankers, helicopters, detection aircraft and fire departments is necessary. These funds provide that ability. In addition, base level funds provide for the employment of temporary personnel, hire of non-state equipment for fire standby and suppression, weather services, use of contracted equipment, fire retardant purchase, permanent employee on-call and overtime costs and other suppression related expenses. Many of the expenditures from this activity are a function of the numbers of fires and control difficulties encountered. Due to the uncertainty of the level of expenditure for this activity, the legislature has chosen to appropriate at a level that is below the needs of an average year. Appropriations can be exchanged between the fiscal years in the biennium; however, to make up for shortfalls contingency funds must regularly be drawn upon. The Fiscal Year 1986 appropriation was $750,000. Actual expenditures totaled $685,600 (Appendix IX). This amounts to an average of three cents per acre protected. The cost per acre of protection will fluctuate by the severity of the fire year (Figure 6).

Figure 6



Appropriations for F.Y. 1987 are $750,000. Of this amount, no more than $410,000 can be expended for presuppression activities. Ten year expenditures average $2,276,000. If the high year is excluded, the average falls to $1,500,000. A change level of $200,000 has been requested. This would raise FY 88 appropriations to $950,000.

Funding for the purchase and major repair of state owned equipment, radio systems and structures are included elsewhere in the DNR budget. These items have a major impact on the division's ability to suppress wildfires; however, present cost accounting systems do not allow for the specific recapture of these expenditures. This problem was addressed and reconciled in the LCMR Economic Analysis of Wildfire Protection study. The results of this study will be presented later in this report.

Federally Sponsored Programs

The Division of Forestry administers three federally sponsored wildfire related programs. These programs impact the division's ability to provide wildfire protection by improving cooperation between the division, other agencies and fire departments.

One of the programs is the Federal excess property program. This program allows the Division of Forestry to loan excess to rural fire departments. This is usually military equipment that fire departments convert to serve fire fighting purposes. The Division of Forestry has participated in the excess property program for more than 20 years. During this time period, more than three million dollars worth of equipment has been placed with 470 fire departments.

The second federally sponsored program is the "Rural Community Fire Protection Matching Grants Program". This is a cost sharing program that is administered by the division. It is designed to improve the ability of rural fire departments to fight structural fires and to cooperate in the suppression of wildfires. The division has participated in this program for the past eleven years. Each year an average of $125,000 has been distributed to between 100 to 130 fire departments. To date $1,536,000 have been distributed. Each department is required to match the funds it receives. Ten percent of the money received for the matching grants program can be used for administration purposes. Since 1980 this program has not been included in the President's budget; however, Congress has continued to provide funds.

Over 450 of the 800 fire departments in the State of Minnesota have benefited from the Excess Property Program and the Rural Community Fire Protection Program. In addition, over 30 communities in Minnesota have organized new fire departments using excess property. These departments have gone on to provide a valuable service to their community and to adjoining fire departments.

The Federal Clark-McNary Act is the third federal program that has aided state budgets in the past. Funds for this program have been reduced by almost two thirds over the past several years, and those that are left are restricted to projects that serve the "national interest" and provide multi-state benefits. Funds allocated to Minnesota in FY 1986 totaled $170,000. The President has suggested budget reductions that would cripple the program.

Funding Considerations

The ability to maintain adequate levels of presuppression funding and preparation has depended upon losses that have been experienced in the recent past. If losses have not been sustained, there is a tendency to allocate funds to other programs. The danger of this occurring is greater during periods of budget reductions.

To be successful, presuppression protection programs must have a high level of stability. The severity of fire danger is a function of weather and therefore it is unpredictable. The goal is to maintain internal capabilities to cope with average to high fire situations. The system must be able to expand quickly and easily using resources from cooperators during extreme periods to meet peak demands. If adequate preparedness levels are not maintained, suppression costs and losses could become extreme.

Fire funds, which are necessary for public safety, have had to compete for funding with non-public safety programs. In the past, there has been a tendency to reduce or divert these funds given the rationale that if a fire occurs, funding will be found to cover the expenses. This is a dangerous approach, which can be very costly in the long run. To remedy this situation, appropriations that directly impact wildfire protection can be identified and protected by exempting them from budget reductions or reprogramming.

The Division of Forestry's fire protection program is directly impacted by several other elements of the division's and department's budget such as equipment, building maintenance and general operations. Reductions in these budgets have resulted in diminished wildfire protection capabilities. Over the past two years budget reductions have resulted in a loss in availability of 86 full time equivalents or person years which amounts to almost 20% of the total available person years in the division. Personnel reductions impact prevention, fire law enforcement, presuppression preparedness as well as suppression abilities. Budget reductions have also necessitated the closure of nine forestry stations. In the long run, this can lead to increased initial attack times, larger fire sizes and increased suppression costs and losses.

Departmental equipment appropriations have not allowed for the scheduled replacement of the equipment necessary for fire suppression. The equipment fleet has reached the point that it is no longer dependable enough to provide an adequate level of public, employee and natural resource protection. For example, many of the heavy equipment units that are used for initial attack, such as tractor plows, bombardiers and water tankers are between 20 and 30 years old. The initial attack

pickup trucks are not being replaced on a regular schedule resulting in a large variation in the condition and reliability of vehicles. The two- way radio system has not been upgraded or replaced since the initial system purchase over ten years ago. The existing types of radios are no longer manufactured. Finally, fire cache equipment that must be depended upon in large fire situations, and includes items such as hose, pumps, handtools, safety equipment, and chain saws is in poor repair. As all of this equipment has aged, repair costs have accelerated and spare parts have become harder to find. The type of equipment which is currently being used was designed for situations that existed 30 years ago, before the current problem of protecting structures in many wildfire situations. The DNR's change level request for equipment funding will begin to rectify this situation.

Funding of wildfire protection in Minnesota is reaching a critical point. Public safety, personal property and natural resources will be at risk if the situation is not corrected in the near future. Significant decreases in abilities have resulted from a 20% decrease in base level budgets between FY 1985 and FY 1987. These reductions have been a factor in employee layoffs, and they have resulted in a decreased ability to pay actual fire suppression and standby costs to private vendors and other governmental agencies. Compounding this is the fact that fire-related budgets have not kept pace with increasing costs. The impact on the fire fund is illustrated in a comparative example in Appendix X. These factors have led the division to an increased dependence on contingency funds that also have been subject to reductions over the past few years.

Wildfire protection must compete for funding with non-public safety programs. To alleviate this problem, protection elements could be given precedence over other general fund programs during budget reductions. If fire funds can not be protected, then another alternative would be to find means of funding the fire program which would reduce its reliance on the general fund. Alternative funding methods and sources are examined in the following section. These alternatives could be a means of providing a more stable funding base for the Division's wildfire protection program.

Alternative Funding Strategies

A preliminary survey was conducted of other state wildfire organizations to explore their funding sources. Results indicate that while a majority of state protection organizations are funded by general fund appropriations, some states do use other methods. Some of these are only meant to provide a supplemental source of funding while others will fund the entire fire protection program or department. The state organizations that are not funded by General Fund appropriation appear to have a more stable funding base.

One alternative would be to impose a per acre protection charge on all public and private landowners. Oregon, Washington and Montana use this method as a means of funding parts of their presuppression, prevention, suppression and training programs. The assessment is based on the

values being protected and the cost of protection. The legislature or an independent forestry board determines the assessment charge on an annual basis.

Another alternative is to require a percentage of homeowner insurance premiums in high risk areas to be devoted to the state protection organization. Delaware receives funding from insurance underwriters based on the number of households in defined protection areas.

A property tax levy based on the value of the land and its improvements might also be imposed. The State of Wisconsin uses a statewide property tax of 2/10ths of a mil to fund its Department of Natural Resources including their fire protection program.

Another possible solution would be to direct a percentage of the state sales tax back to fire protection. The State of Missouri funds its Department of Conservation, including their wildfire protection program, via a sales tax of 1/8th of 1%.

Finally, all expenses collected by the state for wildland fire suppression and prevention might be returned to the original fund from which the expenses were paid. This alternative is included as part of a legislative proposal for the 1987 legislative session. It would only result in minor improvements to the programs funding problems.

The purpose of this brief survey was to provide an overview of alternatives to the method Minnesota uses to fund wildfire protection. It is suggested that additional discussion regarding the desirability of alternative funding take place with the appropriate state agencies. If it is then decided to proceed a plan should be developed for presentation to the 1989 legislature.

EFFICIENCY OF THE WILDFIRE PROTECTION PROGRAM

Due to increasingly tighter budgets, the Division of Forestry has been looking into alternative methods for determining the cost effectiveness and overall cost efficiency of its fire protection program. In the past, the division has tried to measure the effectiveness of its fire program by various methods, none of which have proven satisfactory. Examples are: average fire size, percentage of protected area burned and cost per acre of protection (Figure 7, Figure 8, Appendix XI). More recently, the division has begun using an economic efficiency analysis to determine the optimal level of fire protection to provide, given the resource and property values being protected.

The Legislative Commission on Minnesota Resources (LCMR) provided the Division of Forestry with funding to conduct this economic efficiency analysis. The National Fire Management Analysis System (NFMAS) was used in this process. NFMAS was developed by the U.S. Forest Service to determine the optimal level of fire protection an agency should provide based on economic efficiency criteria. The analysis is based on the assumption that the more prepared an agency is for the incidence of wildfire, the more efficient they will be in suppressing wildfires and minimizing losses. To determine the point of diminishing returns, historical fire occurrence, fire behavior, equipment dispatching, cost

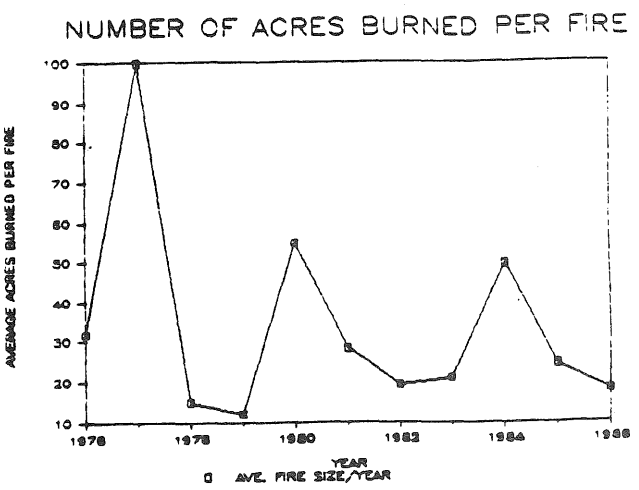


Figure 7

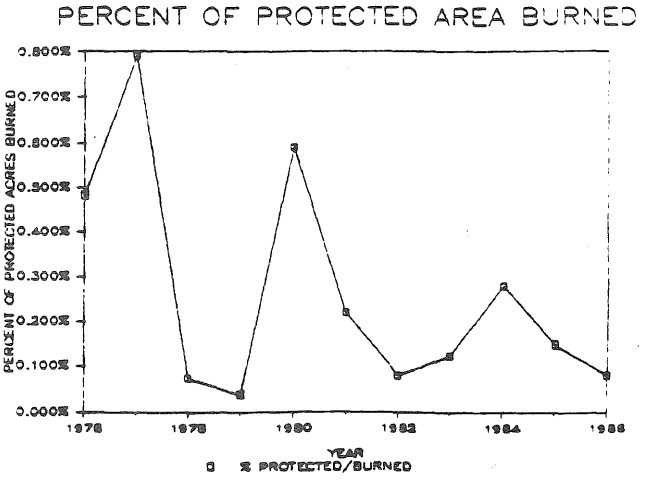


Figure 8

and loss information are used to analyze alternative presuppression funding levels. The level of presuppression funding which results in the lowest total costs and losses will be the most cost efficient.

The fire management analysis was performed at the area, region and statewide levels. The results from the statewide analysis indicate that a substantial savings in suppression costs, losses and acres burned can be achieved if the DNR expends additional presuppression funds to develop and maintain a prepared firefighting organization. The most cost efficient level of presuppression funding would occur with a 14% increase in funding over historic (1982) levels. This increase corresponds to the minimum point on a curve illustrating the total costs and losses of Minnesota's wildfire protection program (Figure 9). This 14% increase in presuppression funding would result in an estimated 47% decrease in suppression costs, a 55% decrease in losses and a 53% decrease in acres burned. The net result of an increase in presuppression funding would be a 29% decrease in total wildfire-related costs and losses.

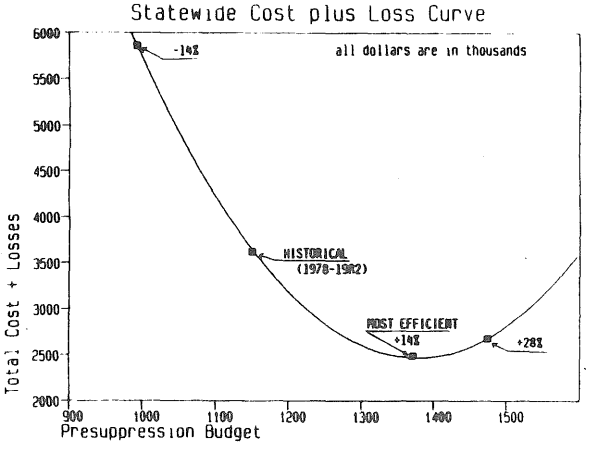


Figure 9

To determine what a 14% increase would amount to in the current year's budget, the FY 1986 budget must first be restored to 1982 levels. This restoration is necessary because current budgets have not kept pace with increasing costs. The restoration of funding when added to the 14% increase in presuppression funding, suggested by the analysis, amounts to $1,295,000. Funds for presuppression activities are found in several Departmental budgets. The results of the economic analysis suggest that 51.7% of this increase or $670,000 can be applied to the Division of Forestry's Fire Fighting Activity, the remaining 48.3% or $625,000 can be applied to the Division's Forest Management Activity and the Department's Field Services Equipment budget.

If the presuppression budget is decreased 14% below historic funding levels, the analysis predicts suppression costs will increase by 107%, losses will increase by 74% and acres burned will increase by 120%. The total effect of a reduction in presuppression funding would be a 62% increase in total costs and losses.

In addition to suggesting that presuppression funding levels should be increased above historic levels, the results show that there is a need for some redistribution of presuppression funding between administrative regions, and between areas within regions. The Division has already begun this redistribution process by changing the fire protection responsibilities within the Metro Area. Metro was the only administrative area in the State which showed that a decrease in presuppression funding would be more economically efficient. Fire protection responsibilities within the Metro Area are now handled by the Cambridge Area. This change has reduced duplication in detection, presuppression and administration efforts between the two areas.

Further results from the Minnesota Fire Management Analysis can be obtained from the Division's report to the LCMR (in press).

WHO BENEFITS FROM WILDFIRE PROTECTION

Wildfires can affect almost every facet of our social and economic life in Minnesota. In the forested areas of the State, wildfire occurrence directly affects two out of the three main industries. Therefore, wildfire protection can be seen as a direct benefit to the people and the economy of Minnesota.

Wildfires can have a devastating effect on the public and private forestlands the timber industry relies on to provide its wood resource. In mature timber stands, wildfires can reduce the volume and quality of harvestable timber. Younger stands and plantations are even more susceptible to damage from wildfire. In both cases, a wildfire can leave the wood resource unsalvageable and result in considerable expense to replant or rejuvinate the area.

The tourism industry bases much of its ability to attract visitors to Minnesota on the beauty of the forests and lakes and the hunting and fishing they provide. A severe fire year can result in restrictions being placed on outdoor activities such as hunting and camping. During 1976 it has been estimated that resort owners suffered over $75,000,000

in losses as a result of wildfire and the accompanying of restrictions. Major wildfires can also adversely impact native fish populations by increasing runoff into streams and lakes. This also impacts the tourism industry in Minnesota.

Permanent and seasonal residents of Minnesota also benefit from wildfire protection. Rural residents, cabin owners and vacationers seldom have the resources to protect their property and themselves in the event of a wildfire. In those areas where wildfire is a more frequent concern, insurance has been more difficult and costly to obtain.

UNINTENDED RESULTS OF THE PROGRAM

While many people have benefited from wildfire protection, the Division's protection program has resulted in some unintended negative consequences.

Wildfire suppression can have a negative impact on wildlife habitat. Wildfires of low and medium intensity can actually stimulate the vegetation growth which large and small game animals rely on for food and cover. These same fires can result in natural resource and property damage. One means of solving this dilemma is through the planned use of fire as a management tool. Prescribed burning under the proper conditions can provide the balance between the beneficial aspects of fire versus the detrimental effects. Prescribed fire can be used to improve wildlife habitat, as well as to eliminate hazardous fuel buildup, thereby reducing the risk of loss of life and damage to private property.

Another unintended consequence of the DNR's wildfire protection program has been the filing of lawsuits and countersuits against the department or individual employees of the department. Some of these suits have stemmed from the department's responsibility for the prevention and suppression of wildfires. The Minnesota DNR is not alone in this situation. Both the Wisconsin DNR and the Washington DNR have been sued recently because they failed to prevent the destruction of homes by wildfire. Wisconsin managed to win their suit, while the Washington case is still pending.

ALTERNATIVE METHODS OF WILDFIRE PROTECTION

Rural fire departments are the only entities, besides the Division of Forestry, that exist as a possible alternative available for wildfire protection. Most rural fire departments already provide some amount of wildfire suppression within their protection area. However, fire departments first priority is to structure fires with wildfires being only a secondary concern. They do not have involvement in weather systems, detection, resource dispatching and coordination, aerial fire suppression, large fire management, arson investigation and law enforcement. In addition, present economic conditions in rural Minnesota are threatening the existence or decreasing the abilities of many rural fire departments. There are other limitations to the use of rural fire departments for wildfire protection. These include the inability to

cover a large geographic area, to fight fires in off road or poorly accessible locations, to handle multiple wildfires over short periods of time and to handle large fires which could take days to suppress. These inabilities are partly due to the fact that 748 of the 800 fire departments in Minnesota are manned by volunteers who are limited in the length of time they can devote to wildfire suppression.

At this time there are many factors that limit fire departments from performing all of the state's wildland fire suppression duties. In the future, the division desires to achieve an even higher degree of cooperation and inter-dependence with fire departments through joint training and resource exchange.

CONCLUSIONS AND SUGGESTIONS FOR PROGRAM IMPROVEMENT

Minnesota's wildfire protection program is not at its optimum level of efficiency. The economic efficiency analysis has shown that pre-suppression funding improvements will result in long range savings in suppression costs and reductions in sustained losses.

Improvements in commitments are necessary in several facets to achieve maximum efficiency. These are detailed in the appropriate segments of this report. In summary they include the following.

* Increases in fire prevention efforts with special emphasis on programs which target specific causes is needed. This will result in reduced fire incidence and suppression cost savings. Staff time for program direction and adequate associated budgets are not available. (Page 5)

* A program, in cooperation with rural fire departments identification of property which is prone to damage from wildfire (fire prone property) and voluntary inspections would help avoid losses and reduce suppression expenditures. This type of program has been successful in Wisconsin. Staff time and associated budgets are needed. (Page 5)

* Encouragement of local zoning authorities and insurance companies to take steps to minimize potential losses and reduce suppression costs. Statewide program direction and coordination is lacking. (Page 5)

* Provide for further increases in arson investigation and general enforcement of fire prevention statutes. Plans are to move in this direction with existing capabilities. Some associated equipment is needed. This is contained in DNR equipment proposals. (Page 5)

* Provide for budgets to allow a continuation of fire planning efforts and the long term cost savings that can result. (Page 7)

* Increase budgets to allow for obtaining of private weather forecasting services. Due to federal budget reductions the U.S. Weather Bureau is not able to provide adequate forecasts. Approximately $25,000 per year would be necessary. Levels of several types of expenditures are based on weather forecasts. (Page 7)

* Existing fire and general DNR equipment is deteriorating to the point that adequate, safe fire suppression is difficult. Increases in funding is necessary for replacement and up grading with equipment that is adequate for current suppression demands. This is being addressed in DNR budget change level requests, however the time frame for solution will require continuing commitments over 10 years. (Page 14)

* Increased abilities to train and cooperate with fire departments will provide additional fire resources to cope with the "rural-urban interface". Increased investments in DNR field time and increased staff time for coordination would be necessary. (Pages 3, 6, 19)

* The complete dependency on cooperators for fire crews is not a desirable situation. Several factors make the employment of crews costly. There may be some provisions in normal employment procedures that could be developed to provide some cost relief. This would require the establishment of a special employee classification and address overtime, physical standards, and other factors. A normal year would require 3 months of fire duty, split between the spring and fall. Lay-off and rehire is not practical because of training and experience factors. Additional departmental projects are necessary in the interim. For two crews, funding of 40 seasonal positions for 7 months plus associated unemployment costs would be required. (Page 10)

* The fire fighting activity contains suppression funding for less than a normal year. This requires frequent requests for contingency funds. Funding for average suppression costs would ease this situation. The trend towards minimal contingency fund levels is of concern. A carry over procedure to use appropriations from below normal years would place less dependency on contingency accounts. There may be other ways to address this problem. In 1986, $750,000 was available in the Fire Fighting Fund. Over the past 10 years, expenditures have averaged $2,276,000. If Fiscal Year 1977, which was extreme, is not included the amount would be approximately $1,500,000. (Page 12)

* As federal budgets are restricted, the state can expect increasing pressures to solve the imbalance problem with the U.S. Forest Service. One approach is to protect portions of the National Forests. This would not be too difficult if fire protection was funded to levels of full efficiency. (Page 8)

Several of the preceding recommendations reference increases in central staff time. This is necessary to provide statewide program coordination. In addition some activities are more efficiently conducted on a statewide basis. Compared to Michigan and Wisconsin, states with similar situations, Minnesota lacks in this area. Additional staffing levels of five positions are necessary to progress with the preceding suggestions. Two of these would be clerical.

There has been a reduction of 20% in operations and management staffing abilities in the division. This has negatively impacted the ability to provide fire protection services. A request for restoration of these funds is contained in the Forest Management Program's change level request entitled, "Operations and Management Staffing".

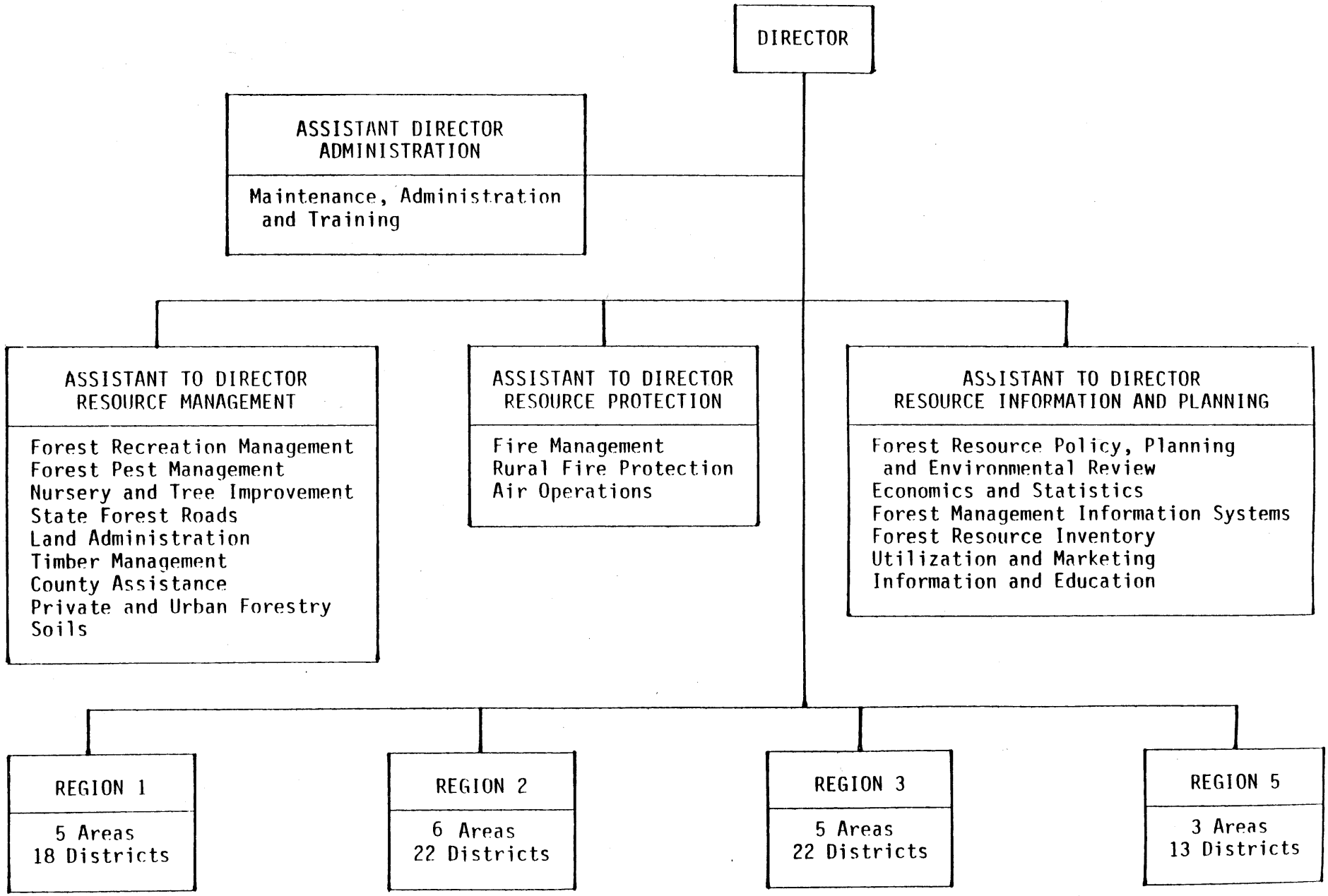
Reductions in the General Fund have resulted in reductions in fire protection abilities. Several states use methods of funding protection programs other than the General Fund. This area would require additional study if a change is to be recommended. It would require input from sources in addition to what is available to the DNR.

Wildfire protection is a public safety function and budget protection is necessary to provide presuppression program stability. Public safety programs require priority. Wildfire protection presuppression funds need guarantees in times of low fire activity, budget reductions and reprograming. Efficient suppression action is dependent upon this. It is suggested that the fire fighting appropriations and appropriate percentages of other departmental funds be afforded this protection. This can be best accomplished by identification along with Legislative and/or Executive Branch action.

APPENDIX I

ORGANIZATIONAL CHART FOR THE DIVISION OF FORESTRY

DIVISION OF FORESTRY - 1986

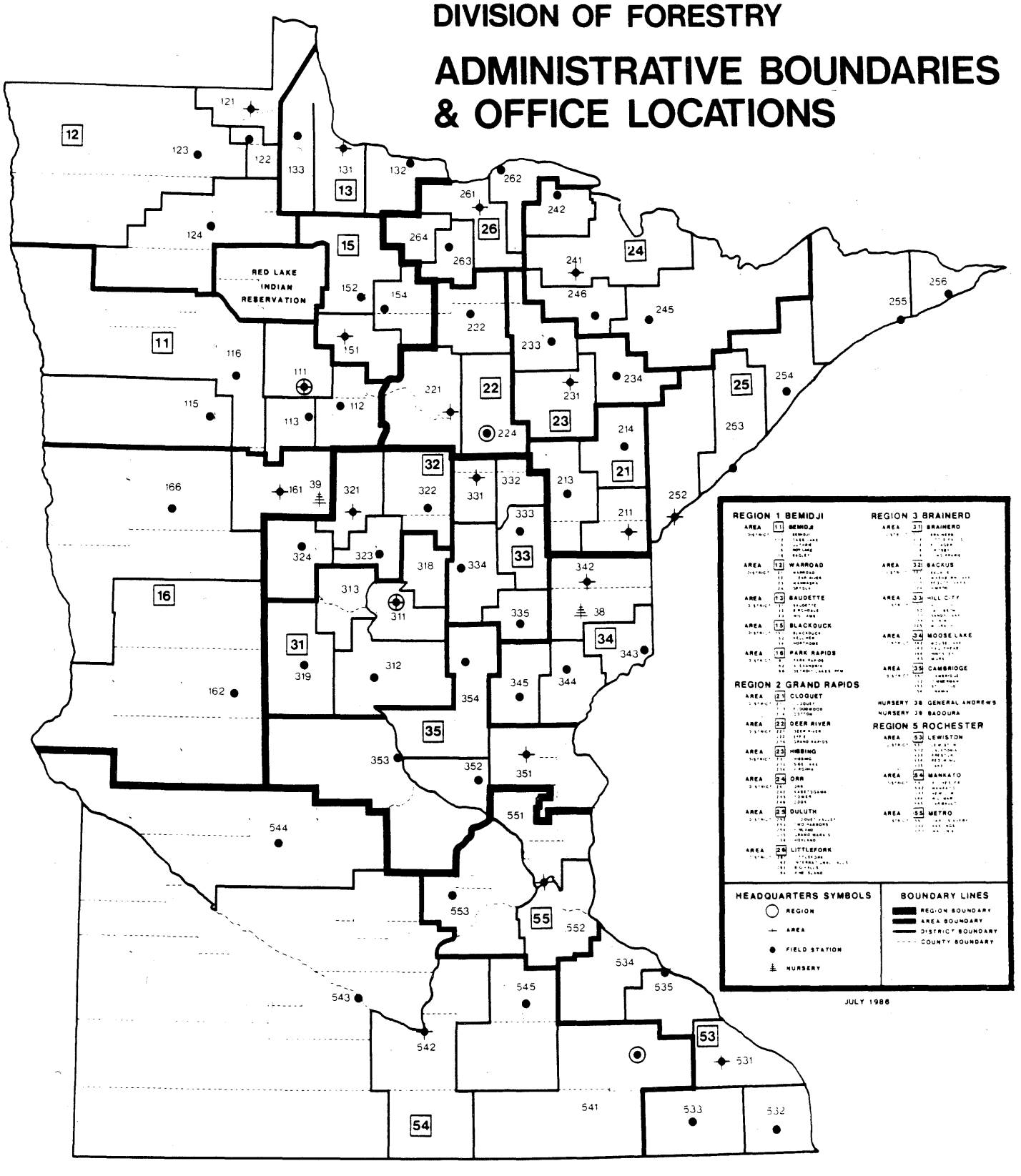


APPENDIX II

DIVISION OF FORESTRY ADMINISTRATIVE BOUNDARIES

DIVISION OF FORESTRY

ADMINISTRATIVE BOUNDARIES & OFFICE LOCATIONS



JULY 1986

APPENDIX III

OPERATIONAL ORDER NO. 57

DEPARTMENT OF NATURAL RESOURCES

OPERATIONAL ORDER NO. 57

February 28, 1977

SUBJECT: Wildfire Protection - Statewide Coordination of Activities

OBJECTIVE:

The objective of this order is to provide a uniform policy of operation during wildfire periods and consistency in wildfire prevention and presuppression programs. The procedures contained in this order will establish some direct lines of communication. It will not remove the responsibility of informing those persons involved in the normal organizational procedure of actions taken within a reasonable time frame.

1. Wildfire Control Center

The St. Paul Forestry Office will serve as the Wildfire Control Center and will be operational when the threat of wildfire exists or there is a need of inter-regional coordination in wildfire activities. The Center shall not lessen the responsibilities of regions to develop all wildfire resources within its boundaries.

Staffing will be a primary function of the Forest Protection staff; however, the Director of Forestry may assign other Forestry staff members and, upon approval of the Commissioner's Office, any other member of the DNR Central Staff that possess necessary areas of expertise.

2. Authorities

When the Wildfire Control Center is operational, it and the Director of Forestry will become a part of field operations. The Director of Forestry and the Control Center will be responsible to the Assistant Commissioner for Field Operations and will operate with that authority delegated by the Assistant Commissioner for Field Operations. This will include the inter-regional movement of manpower and equipment to areas of greatest priority.

3. Wildfire Manuals and Directives

It will be the responsibility of the Director of Forestry, with the approval of the Assistant Commissioner for Field Operations, to prepare manuals or directives expanding upon the subjects contained in this order or additional subjects as needed.

4. Wildfire Training Teams

Training must be consistent in all regions so personnel are functioning under common criteria; however, it is not possible to give this training directly to all DNR personnel and cooperators affected by wildfire activities. For this reason, it is necessary to establish regional training teams. The teams shall be selected from Forestry personnel and shall contain five (5) individuals with wildfire background and training abilities. Each team shall have a leader designated. Regions 1, 2, and 3 shall have one team each. Regions 4, 5, and 6 and St. Paul shall provide the fourth team. They will be responsible to the Regional Forest Supervisor with coordination from the Director of Forestry, the Regional Adminis-

trators, and the Assistant Commissioner for Field Operations.

The teams will attend training sessions and will plan and conduct training for Forestry personnel, other DNR personnel as selected by the Regional Administrator, overhead teams, suppression crews, fire departments, and other cooperators. Training will be by priorities established and coordinated by the Director of Forestry.

The team leaders shall maintain contact to provide uniformity in training.

5. Wildfire Personnel Qualifications System

It will be the responsibility of the Director of Forestry, in cooperation with the Regional Administrators, to develop a Wildfire Personnel Qualification System. The qualification system will utilize personnel engaged in forestry activities as well as those in other disciplines. This system shall have common characteristics with the U.S. Forest Service's "red card system" because of national standards.

A system shall be developed and maintained to contain current files regarding personnel, location, types of training received, physical condition, availability, and other pertinent information.

6. Wildfire Prevention

Implementation of burning bans, road closures, restricted recreation, etc., will only be initiated by the Commissioner's Office.

The Regional Forest Supervisor should carefully gather statistics supporting or demonstrating that such a restriction is needed. This information should be relayed to the Regional Administrator. Upon

collection of such information, it should be forwarded to the Assistant Commissioner for Field Operations. He will then consult with department staff to coordinate the gathering of additional statistical data and recommendations. The Assistant Commissioner for Field Operations will then provide this information to the Commissioner. Upon consultation with all affected disciplines and Regions, a decision will be made. Once such a decision is made, the effectiveness of the technique being used will be greatly enhanced by thorough explanation to all news media and interested parties. The general announcement of the ban and the explanation will be immediately forwarded to the Regional Administrator by the Assistant Commissioner for Field Operations. The Regional Administrator will immediately see that appropriate field personnel are notified.

7. Fire Overhead Teams

It shall be the responsibility of the Director of Forestry to provide guidelines for the establishment of fire overhead teams. It shall be the region's responsibility to establish such overhead teams. Each team shall consist of individuals who can function effectively in their assigned role. The "fire boss" shall be from the Forestry discipline and other discipline personnel shall be considered for integral members of the teams. The Director of Forestry shall establish an overhead team(s) comprised of individuals of various disciplines from the DNR Central Office Staff.

When overhead team(s) are needed, the region shall first activate the team(s) established within the region. If needs cannot be met within the region, a request should be directed by the Regional

Administrator, or his delegate, to the Wildfire Control Center.

Teams are to be available for inter-regional and out-of-state assignment.

The main purpose of an overhead team is to relieve personnel from duty on an active fire which is detracting from initial attack ability. Upon recognizing the need for an overhead team, the local foresters shall go through channels to the regional office. Overhead teams will report directly to the Regional Forest Supervisor. The overhead team's responsibility will not end when the demobilization from the fire is completed. There will be additional responsibilities in terms of preparing the fire report, processing invoices, questions concerning timekeeping, etc. Total deactivation of a team will be the responsibility of the region in cooperation with the Fire Control Center.

8. Inter and Intra-Regional Wildfire Suppression Crews

The Director of Forestry will be responsible for developing guidelines for the recruitment, employment and training of personnel to serve on inter and intra-regional Wildfire Suppression Crews. Crews will be established in Regions 1, 2, and 3. Intra-regional dispatching of the crews will be through the Regional Forest Supervisor. The inter-regional dispatching of crews shall be accomplished through the Fire Control Center.

9. Personnel Specializations in Wildfire Activities

The Director of Forestry shall identify areas of wildfire specialization as they arise, and through the Assistant Commissioner for Field Operations, provide for the fulfilling of these needs from

department manpower or other sources. It shall also be the Director of Forestry's responsibility to provide adequate training.

10. Personnel Rotation

When personnel fatigue occurs, rotation of personnel shall be initiated. The area should make its request to the Regional Forest Supervisor. If possible, he should then provide help from within the region. If this is not possible, the Regional Administrator or his delegate shall then contact the Wildfire Control Center.

11. Personnel Needs Exceeding Regional Resources

Emergency wildfire situations and active fires may surpass the regional abilities to supply individual firefighters, support personnel, and organized crews. It shall be the Regional Administrator's responsibility, or his delegates, to request additional manpower from the Wildfire Control Center. This request will first be filled by utilizing personnel resources in other regions. When it becomes apparent that resources within the state are exhausted, the Wildfire Control Center will look to other sources.

National Guard troops shall not be considered a local resource. All requests for National Guard assistance must be directed to the Wildfire Control Center. The Center will cooperate with the Commissioner's office in establishing the details necessary to provide guard assistance.

When a region has personnel obtained through the Wildfire Control Center, it shall provide information to the Center concerning any change in status of the crew or individuals. The region shall maintain

payrolling records and supervision of crews within the region. The Wildfire Control Center will maintain status, location, etc., pertaining to these personnel.

The personnel shall not be looked upon as a regional resource to be held in the advent of another emergency. The Wildfire Control Center will have authority to move individuals and crews to areas of greater priority.

12. Cooperative Agreements

Local cooperative arrangements with other agencies in fire prevention, presuppression and suppression are encouraged. This can do much to enhance our total fire effort. However, field activities should be restricted to those of local consequence. For example, the Chippewa National Forest and the Superior National Forest have a variety of fire equipment and resources. Local cooperation in the mutual use of such equipment is encouraged. Region 9, U.S. Forest Service, maintains a fire cache in the Superior National Forest for use by all agencies throughout the region. Requests for this cache must be directed to the Wildfire Control Center.

13. Wildfire Equipment Cache

It shall be the responsibility of the Director of Forestry and the Administrator, Bureau of Field Services, to establish a statewide wildfire equipment cache. All requests for equipment from the cache will be through the Wildfire Control Center. It will only be used in the event equipment is no longer available from regional sources or when using regional resources will significantly detract from the initial attack capabilities.

The Center will have the authority for intra-state movement of equipment and to initiate action to return equipment to the cache. Cooperative use of the cache by other agencies shall be directed to the Wildfire Control Center and will be approved by the Assistant Commissioner for Field Operations.

Budgetary details to establish and maintain the cache are the responsibility of the Director of Forestry and the Administrator, Bureau of Field Services.

14. Equipment Needs Exceeding Regional Resources

Each region shall establish an equipment availability plan considering all sources. When regional resources are exceeded, the Regional Forest Supervisor shall contact the Wildfire Control Center. The fire control center will look at sources of DNR equipment in other regions and coordinate with the Assistant Commissioner for Field Operations. If the control center cannot meet requests within the state, they shall develop a procedure for obtaining equipment from other agencies and other states.

Equipment obtained through the Wildfire Control Center shall not be viewed as equipment to be held in reserve. The Center will have the capabilities of moving this equipment to any area of the state upon establishment of a greater need. Regional records shoould include receipt, location, and movement within the region. The Fire Control Center will record the time and place assigned.

Specialized equipment requests which are not available locally shall be directed by the Regional Forest Supervisor to the Wildfire Control Center. The Center shall have plans developed for obtaining such equipment.

15. Specialized Air Operations

All water and retardant cascading aircraft (air tankers and helicopters) are placed under the direction of the Wildfire Control Center. The fire protection staff, in consultation with the regions, will designate main and satellite air tanker bases. The dispatching of air tankers and helicopters will be under guidelines developed by the fire protection staff and will be a function of the Wildfire Control Center. Even though aircraft may be located in an administrative area, they should not be considered as only a local resource.

The use of cascading aircraft requires certain personnel who are well trained in the operation. The necessary personnel requirements will be developed by the Director of Forestry and the Regional Administrators.

The necessary budgeting and contractual procedures to obtain such aircraft will be a responsibility of the Director of Forestry.

16. News Media - Wildfire

It will be the function of the Wildfire Control Center to daily, more often if the circumstances necessitate, assemble critical information. This information will be summarized in the form of a daily fire situation report. The report will include such things as number of new fires, total number of fires, acres burned, personal property destroyed, details on any fires of significant consequence, etc.

Field information on any unusual happenings, fires, etc., are instructed to be relayed to a member of the St. Paul Fire Protection

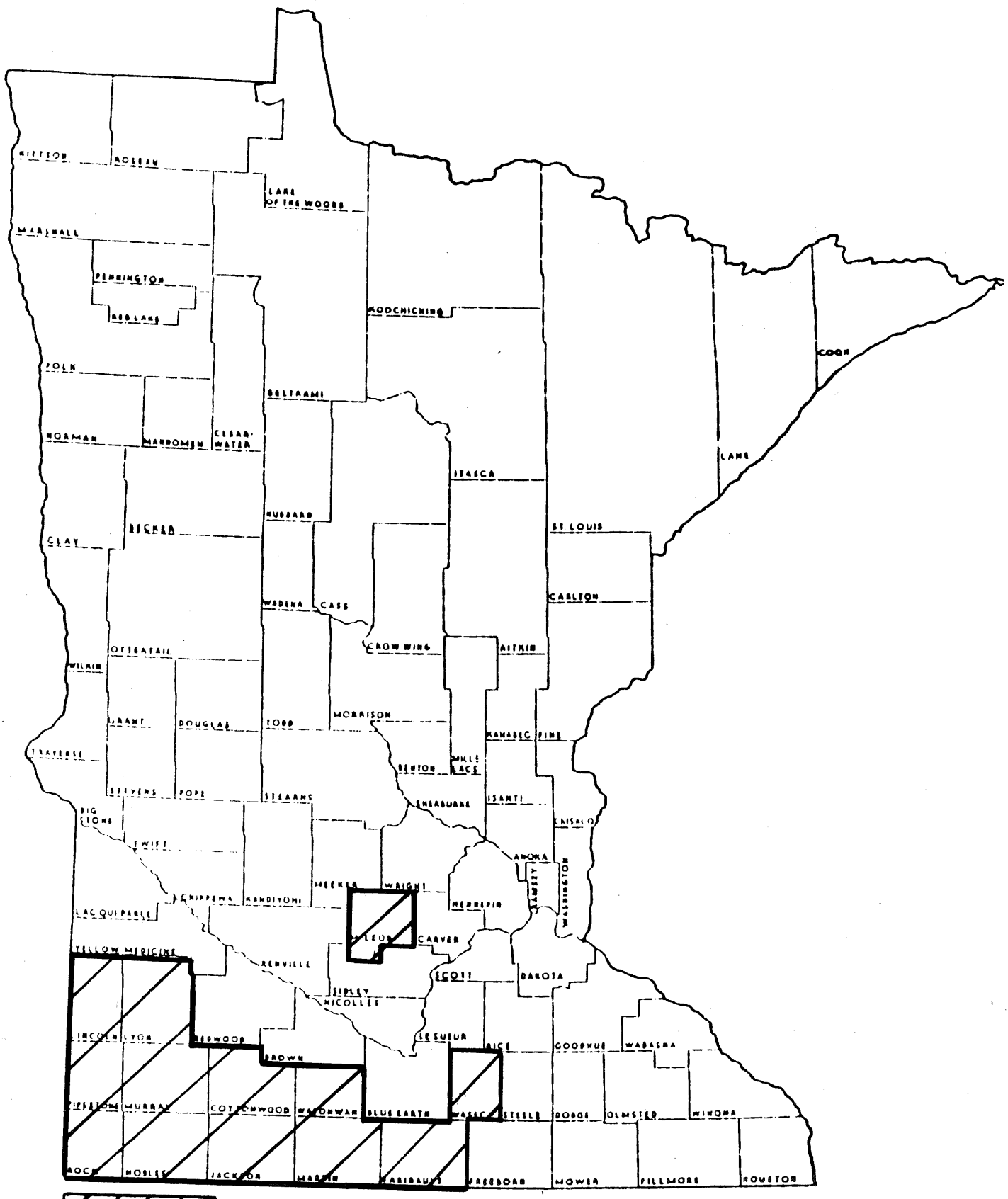
Staff as soon as possible. This contact should be made regardless of the hour of the day. Our credibility with the news media is greatly enhanced when we can provide them with information concerning any significant event.

/s/ Michael C. O'Donnell
Office of the Commissioner

APPENDIX IV

NON-FORESTED COUNTIES IN MINNESOTA

NON-FORESTED COUNTIES IN MINNESOTA



Counties which do not fit the definition of forest areas found in M.S. Sec. 88.01. Subdiv. 6.

APPENDIX V

TIME SPENT ON FIRE ACTIVITIES

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FORESTRY

TIME SPENT ON FIRE ACTIVITIES AS RELATED TO DIVISION TIME
BY PERSON YEARS (ONE YEAR = 1,730 HOURS)

	FISCAL YEAR											
TASK	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	AVERAGE	PERCENT OF TIME
PREVENTION	3.39	2.33	2.13	3.52	4.01	3.66	3.63	4.05	5.53	5.26	3.75	6.3%
PRESUPPRESSION	29.43	19.71	16.77	29.22	28.26	28.78	29.14	30.57	34.68	24.45	27.10	45.4%
SUPPRESSION	101.52	15.87	13.22	46.58	26.46	12.55	13.93	10.87	18.23	29.48	28.87	48.3%
TOTAL	134.34	37.91	32.12	79.32	58.73	44.99	46.70	45.49	58.44	59.19	59.72	

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FORESTRY

WILDFIRE CAUSE

WILDFIRE CAUSE	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	EST. 1986	AVERAGE	PERCENT
LIGHTNING	12	13	10	4	15	3	3	13	7	13	9	9.3	0.6%
CAMPFIRE	42	13	20	2	36	19	11	22	33	22	16	21.5	1.4%
SMOKING	237	114	74	58	59	51	58	63	55	37	40	76.9	4.9%
DEBRIS	1221	723	379	198	972	695	353	430	400	505	361	567.0	36.1%
ARSON	993	650	328	272	1003	710	264	499	466	517	359	551.0	35.1%
EQUIPMENT	280	66	60	21	75	58	61	64	63	46	40	75.8	4.8%
RAILROAD	192	67	75	42	72	65	66	64	73	59	65	76.4	4.9%
CHILDREN	187	90	90	42	120	95	59	90	91	67	49	89.1	5.7%
MISC.	276	71	82	74	111	79	73	82	90	102	81	101.9	6.5%
TOTAL	5416	1807	1118	713	2463	1775	948	1327	1278	1368	1020	1568.8	100.0%

APPENDIX VII

SAMPLE MANNING GUIDE

MANNING AND SPECIFIC ACTION GUIDES

FIRE PRECAUTIONARY STATUS FROM AREA 12 MATRIX - MODEL L

	CLEAR 144 days	PRECAUTION 34 days	WATCH 6 days	WARNING 4 days
DETECTION				
Towers	0	River & Clear River 1100 - 1700 1 Flt East	River & Clear River 1000 - 1800 2 Flts East	All towers 0900 - 1800 2 Flts East
Aerial	0	1 Flt West	2 Flts West	2 Flts West
Area Phone Manned	normal	1000 - 1700	0900 - 1800	0800 - 1800
AREA OFFICE				
Personnel				
On duty	normal	2	4	4
On call	0	1	1	1
Equipment				
Initial Attack	ready	1	1	1
State equipment	ready	loaded	loaded	loaded
Private equipment	none	ready	1 loaded	2 loaded
WARROAD DISTRICT				
Personnel				
On duty	normal	1	2	2
On call	none	1	1	2
Smokechasers	none	2	4 Initiate Patrols	6 Combine Patrols
Equipment				
Initial attack	loaded	loaded	loaded	loaded
State equipment	ready	loaded	loaded	loaded
Private equipment	none	ready	loaded	2 loaded
CLEAR RIVER DISTRICT				
Personnel				
On duty	normal	1	2	2
On call	0	1	1	2
Smokechasers	0	2	4 Initiate Patrols	6 Combine Patrols
Equipment				
Initial attack	loaded	loaded	loaded	loaded
State equipment	ready	loaded	loaded	loaded
Private equipment	none	ready	1 loaded	1 loaded

	CLEAR 144 days	PRECAUTION 34 days	WATCH 6 days	WARNING 4 days
WANNASKA DISTRICT				
Personnel				
On duty	normal	2	3	3
On call	0	1	2	3
Smokechasers	0	3	6	6
			Initiate Patrols	Combine Patrols
Equipment				
Initial attack	loaded	loaded	loaded	loaded
State equipment	ready	loaded	loaded	loaded
Private equipment	none	ready	loaded	loaded
GRYGLA DISTRICT				
Personel				
On duty	normal	1	2	2
On call	0	1	2	2
Smokechaser	0	2	4	4
Equipment				
Initial attack	loaded	loaded	loaded	loaded
State equipment	ready	loaded	loaded	loaded
Private equipment		ready	loaded	loaded
GREENBUSH DISTRICT				
Personnel				
On duty	normal	1	1	1
On call	0	1*	1*	1*
Smokechasers	0	1	2	2
Equipment				
Initial attack	loaded	loaded	loaded	
State equipment				
Private equipment	ready	ready	loaded	loaded

* Same man as there is only one at Greenbush

State equipment includes:
- two J-5 bombers
- two 6x6 GSA trucks
- one timber jack skidder w/tank
- one 450 JD w/plow & dozer
- one HD5 Allis w/dozer
- one T 6 Int'l w/dozer

FIRE WEATHER PRECAUTION STATUS MATRIX

AREA

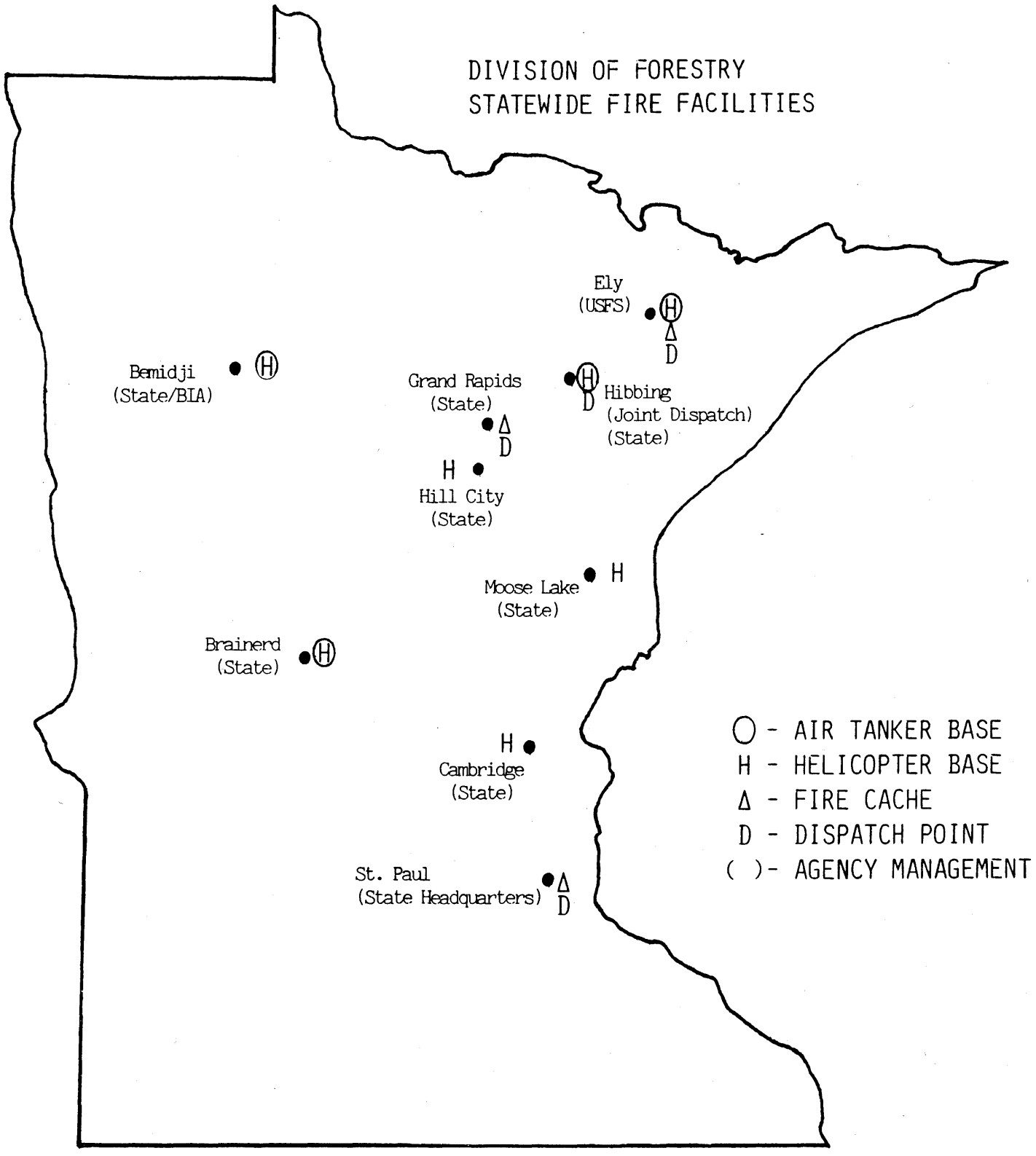
YEARS 1971 - 1979 (9)

BURNING INDEX				IGNITION COMPONENT				
MODEL	MODEL Q	MODEL E	MODEL L	0-20	21-45	4665	6680	81-100
	0-19	0-19	0-10				M	M
	20-39	10-19	11-20		M	M	M	
	40-48	20-23	21-25	M	M			
	49-57	24-28	26-30	M	M			
	58-67	29-32	31-35	M	M			
	68-77	33-37	36-40	M	M			
	78-84	38-41	41-45	M				
	85-92	42-46	46-50	M				
	93-114	47-59	51-64					
	115-137	60-72	65-78					
	Conifers	Dormant Hardwood	Perennial Grass					

NUMBER OF DAYS AND PERCENTAGE IN EACH PEAK SEASONS 3-20 TO 6-08 AND 9-10 TO 11-20				
MODEL		PRECAUT.		
L	136 - 76%	33 - 18%	7 - 4%	3 - 2%
E	101 - 64%	49 - 31%	5 - 3%	4 - 3%
Q	104 - 65%	46 - 29%	5 - 3%	4 - 3%

APPENDIX VIII

STATEWIDE FIRE FACILITIES


DIVISION OF FORESTRY
STATEWIDE FIRE FACILITIES
Ely
(USFS)
Bemidji
(State/BIA)
Grand Rapids
(State)
Hibbing
(Joint Dispatch)
(State)
Hill City
(State)
Moose Lake
(State)
Brainerd
(State)
Cambridge
(State)
St. Paul
(State Headquarters)
O - AIR TANKER BASE
H - HELICOPTER BASE
Δ - FIRE CACHE
D - DISPATCH POINT
( )- AGENCY MANAGEMENT

APPENDIX IX

PAST FUNDING BY FISCAL YEAR

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FORESTRY
WILDFIRE PROTECTION

TOTAL ACRES PROTECTED = 22,800,000

FISCAL YEAR

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	AVERAGE
GENERAL OPERATIONS AND MANAGEMENT ACCOUNT											
FUNDS AVAILABLE(1)	6350.9	6278.1	8124.6	8797.6	10108.2	12002.1	12199.1	13052.5	10781.0	10836.9	9853.1
TOTAL DIV. TIME(2)	381.5	342.0	333.2	455.5	503.9	498.3	514.3	504.8	529.7	451.2	451.4
TOTAL FIRE TIME(3)	134.3	37.9	32.1	79.3	58.7	45.0	46.7	45.1	58.4	59.2	59.7
% WILDFIRE TIME(4)	35.2%	11.1%	9.6%	17.4%	11.6%	9.0%	9.1%	8.9%	11.0%	13.1%	13.2%
PROTECTION COST(5)	2235.7	695.7	782.7	1531.6	1177.5	1083.9	1107.7	1166.1	1188.6	1421.9	1302.4
COST/ACRE PROTECTED	0.10	0.03	0.03	0.07	0.05	0.05	0.05	0.05	0.05	0.06	0.06
FIRE FIGHTING ACCOUNT											
FUNDS AVAILABLE(1)	100.0	100.0	100.0	300.0	300.0	340.0	358.7	930.7	967.6	750.0	424.7
CONTINGENCY FUNDS	11237.2	589.3	527.2	2735.3	1723.0	474.8	866.1	0.0	473.2	0.0	1862.6
FUNDS EXPENDED	11337.2	689.3	627.2	3035.3	2023.0	814.8	1224.8	884.1	1440.8	685.6	2276.2
COST/ACRE PROTECTED	0.50	0.03	0.03	0.13	0.09	0.04	0.05	0.04	0.06	0.03	0.10
TOTAL COST/ACRE OPERATIONS/FIRE F.	0.59	0.06	0.06	0.20	0.14	0.08	0.10	0.09	0.12	0.09	0.15

(1) LEGISLATIVE APPROPRIATION IN THOUSANDS DOLLARS 120 = 120,000
(2) TIME EXPENDED ON ALL ACTIVITIES IN PERSON YEARS - ONE PERSON YEAR = 1730 MAN HOURS
(3) TOTAL MAN YEARS EXPENDED ON ALL FIRE ACTIVITIES
(4) % OF DIVISION TIME SPENT ON FIRE ACTIVITES
(5) PRORATED BY % OF TIME EXPENDED IN THOUSANDS DOLLARS 0.120 = 120,000

APPENDIX X

BUDGET COMPARISON

PRESUPPRESSION COSTS
FISCAL YEAR 1981 COMPARED TO FISCAL YEAR 1987
FIRE FIGHTING FUND

FIRE FIGHTING RESOURCE	ACTUAL FISCAL YEAR 1981	MAINTAIN FY81 LEVEL IN FY 1987	PLANNED FY 1987 ACTIVITY
AIRTANKERS	90 DAYS AT $723/DAY = $65,070	$68,900	90 DAYS AT $765/DAY = $68,900
HELICOPTERS	300 DAYS AT $428/DAY = $128,400	$160,500	220 DAYS AT 535/DAY = $117,600
FIRE CREWS	90 DAYS AT $1,693/DAY = $152,370	$243,360	
EMPLOYEE FRINGE	$30,500	$36,500	
UNEMPLOYMENT			
EMPLOYEE OVERTIME		$125,000	$150,000
FIRE DEPARTMENT CONTRACTS	$5,000	$10,000	$10,000
AERIAL DETECTION CONTRACTS		$10,000	$15,000
TOTAL	$381,340	$654,260	$361,500

APPENDIX XI

ANNUAL FIRE STATISTICS

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FORESTRY

NUMBER OF WILDFIRES AND ACRES BURNED BY YEAR

	CALENDAR YEAR											
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	EST. 1986	AVERAGE
ACRES BURNED	109,992	180,595	16,674	8,521	134,375	50,179	18,277	27,823	62,897	33,346	18,360	60,094
NUMBER OF FIRES	3,440	1,807	1,118	713	2,463	1,775	948	1,327	1,278	1,368	1,020	1,569
AVE. FIRE SIZE	32.0	99.9	14.9	12.0	54.6	28.3	19.3	21.0	49.2	24.4	18.0	38.3
PERCENT OF PROTECTED AREA BURNED	0.482%	0.792%	0.073%	0.037%	0.589%	0.220%	0.080%	0.122%	0.276%	0.146%	0.081%	0.264%