



The heritage of a people is a gift for all to enjoy—not for a few to destroy. Such a heritage is the timber of Minnesota. The North Star State with her pine scented air and sparkling lakes and streams may always hold an enviable place among her sister states, provided she retains her forests. Without them, commercial resources, wild life refuges, water shed protection, and nationally famous recreational areas would be lacking.

The Division of Forestry calls upon all Minnesotans and visitors to co-operate in the wise use and protection of the state's forests.

Report all fires regardless of size to nearest forest officer or local telephone operator, collect.

Following is a list of towns in Minnesota in which ranger stations are located:

Moose Lake  
Cloquet  
Brainerd  
Hibbing  
Deer River  
Hill City  
Bemidji  
Park Rapids  
Arago

Warroad  
Baudette  
Blackduck  
Littlefork  
Orr  
Tower  
Duluth, 201 Folz Bldg.  
Grand Marais  
Grand Rapids



G. M. Conzet, Director  
Division of Forestry  
State Office Building, St. Paul, Minnesota

## FORESTRY IN MINNESOTA

Forest Fire Protection  
Contributed by Division of Forestry



State of Minnesota, Department of Conservation  
Herman C. Wenzel, Commissioner

1937





## FOREST FIRE PROTECTION

Revised by A. E. Pimley

Assistant in Charge of Fire Prevention

Forest fire protection is perhaps the most important of all conservation activities; without it all phases of the work cannot be entirely successful. Besides, the destruction of human life, the forests, game, recreation, and water control are all affected by fire.

It was almost certain that extensive logging operations in Minnesota would be followed by destructive forest fires. Two centuries of logging have pretty well established the custom of cutting the forest clean in one section and then passing on to another. The disappearance of the forests in any one state did not cause alarm, because people were accustomed to think of the remainder of the country as possessing an inexhaustible and easily available supply. The fact that much of the timber supply had already been used up did not seem to shake their belief in the least. However, tremendous forest fires which burned over thousands of acres and destroyed scores of lives began to cause some concern. This led to the gradual adoption of forest conservation measures in Minnesota.

It was not until 1894, however, that real action came, when the great Hinckley fire rose out of the swamp on the wings of a hurricane; destroyed the flourishing town of Hinckley; swept over 160,000 acres; and burned to death 418 people.

Since 1894, there have been 986 human lives destroyed by forest fires in Minnesota and many others died from exposure or other indirect causes.

### State Fire Wardens

The Legislature, in 1895, appointed General C. C. Andrews, Deputy Forest Commissioner and Chief Fire Warden. General Andrews had previously served as Ambassador to Sweden, and had at that time submitted several reports on the management of the forests in that country. He urged similar action here. He was given authority to fight forest fires, but insufficient funds were appropriated to do effective work. He organized a system of township fire wardens. This was not very effective because the wardens served without pay except when actually engaged in fire fighting; and the public was not generally in sympathy with their work.

### The Minnesota Forest Service

After the Baudette and Spooner fire of 1911, where 29 lives were lost and more than 300,000 acres burned over, a new organization was set up under the direction of a state forester.



This was the beginning of the present state forestry organization which is known as the Division of Forestry, commonly called the Minnesota State Forest Service, and which is now a unit of the Department of Conservation.

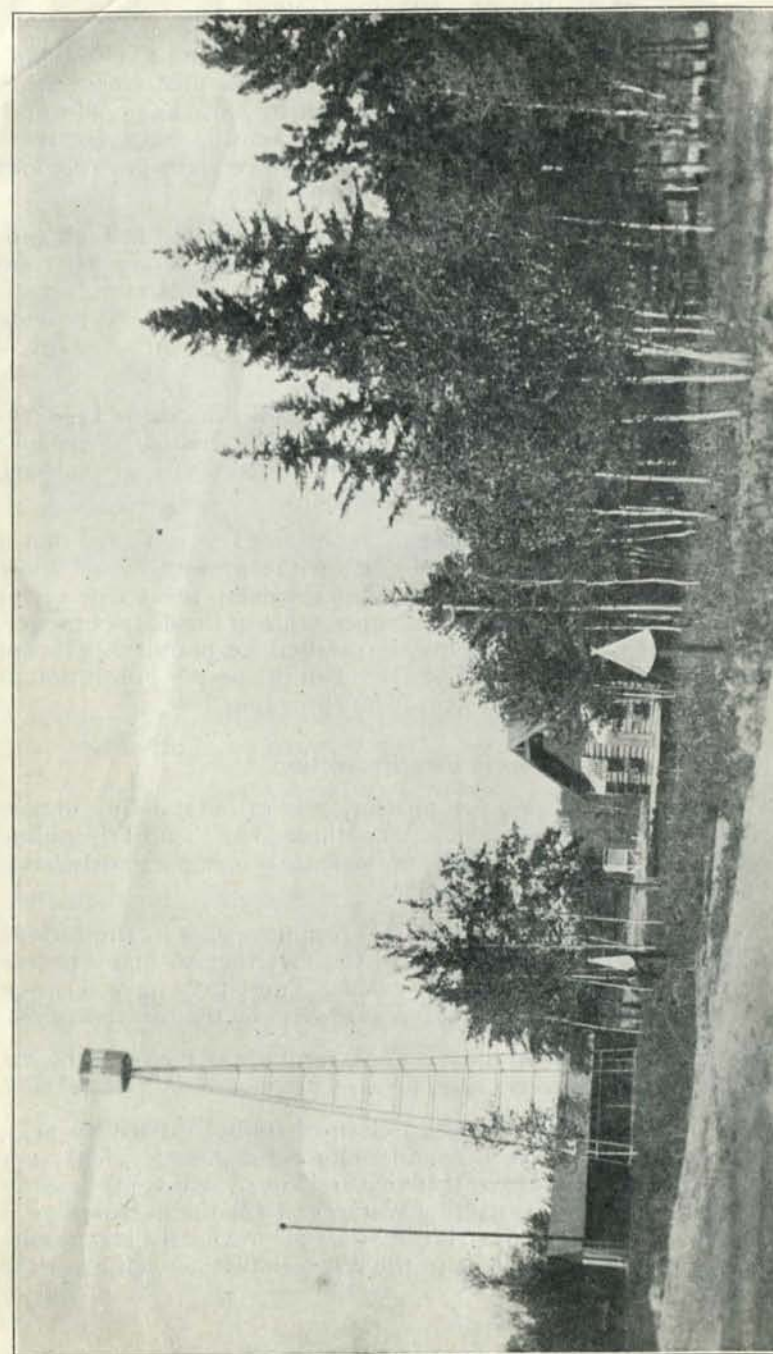
#### Fire Districts

The northern part of the state is divided into 18 ranger districts, with a ranger in charge of each. The districts vary in size from one-half million to 2,600,000 acres, and the total area covered by fire protection in the state is the gross acreage of approximately 20,000,000 acres. Each ranger district has from two to seven patrolmen and lookout tower watchmen during the fire season of each year—a period from about the middle of April until the last of October. The permanent force in all districts together is approximately eighty men; to this number one hundred to one hundred fifty men are added during emergency periods. In addition there are co-operative patrolmen paid by lumber and railroad companies. These patrolmen work under the supervision of the district rangers during the fire season, and also volunteer co-operative key-men who are located at various points throughout the protection area.

#### Towers and Tower-Watchmen

When the present tower building program is completed, there will be one hundred fifty steel observation towers in the state, each of which will overlook an approximate area of 100,000 acres. These towers are from forty to one hundred feet in height and have glass enclosed "crows-nests" on top. They are strategically located on the highest convenient points in each district; each tower being equipped with a map of the area which can be seen from it, an alidade or sight instrument, a vernier scale to determine the exact angle or direction of the fire, and a telephone which is connected to the ranger's headquarters.

Some of the towers have steel stairways, and the public is welcome to climb them when they are open. Thousands of people touring the northern part of the state visit these towers during each summer. The tower watchmen are glad to answer questions about forestry and help people know and make the best use of the forest. Towermen are on duty all day during the fire season. Their duties are to locate the direction of the fire by means of instruments; estimate the distance and size; and make a report to the district ranger. When the ranger at district headquarters gets readings on the same fire from other towers, he projects the lines of direction on a large wall map which is hung in his office according to the lookout tower reports. This is known as the triangulation system. Using this method, the fire is accurately located by noting the point on the map where the lines of direction cross.



*Lookout Tower and Ranger Station.*



### Township Fire Warden or Key-man

One of the important auxiliary fire protection units is the key-man or township fire warden organization. The men constituting this force are unpaid, except when they are actually engaged in fire work. In most cases they are members of township boards, mayors of cities, or presidents of village councils. However, the law provides that any citizen may be appointed to the position.

There is at least one warden strategically located in each geographic township in the entire protection area; and two or more are appointed, in many instances, so that burning permits may be conveniently procured by those requiring them; and also, to provide additional fire protection in territories where the fire hazard is extremely high.

It is one of the regular duties of all township boards to do everything possible to prevent and suppress forest fires in their townships; and after the board members have been appointed as special wardens, they act both as township and state officials.

Before any burning is done, the state fire law provides that a permit must be procured at times when the ground is not snow covered. Another important duty of the township fire warden is to issue these permits under the direct supervision of the district ranger. During the time when burning may be safely done, permits are issued only to responsible persons who have taken the proper precaution to eliminate the danger of their fires from spreading.

### Forest Fire Protection

The problem of forest fire protection is of outstanding importance in Minnesota today, and it will continue to be so until the public realizes that the economic welfare of the state is being seriously hampered by continued forest fire losses.

The public, however, is rapidly becoming aware of the serious situation, due in a great measure to the fact that so many people spend their vacations in the north woods. There they have seen the vast stretches of land stripped of forest growth by the recurrent fires.

The solution of the problem is the careful use of the forest by the people and greater protection measures by all governmental agencies.

Besides the tremendous destruction of timber caused by fires, two outstanding facts are becoming more and more evident: (1) Denuding watershed areas of their natural cover, which takes away the greatest factor for controlling water, and (2) the destruction of wild life cover (shelter) over large areas of previously ideal game territory, which is a great loss to the recreationist as well as to the state as a whole.



*Ground Fire Results.*

### Fires

Fires are generally classified into three types, namely: ground fires, surface fires, and crown fires.

In places where a large accumulation of humus makes ground fires particularly hard to extinguish, the digging of trenches with shovels or very heavy hoes; or the construction of furrows with plows either drawn by tractors, horses, or trucks are the most common methods employed where power-driven pumps cannot be used.

Peat fires, which come under the classification of ground fires, because of the high inflammability of dry peat are very difficult to control. One of the most common methods of combating this type of fire is to construct a trench along its edge; digging down to either mineral soil or wet peat; at the same time making sure that all roots, burned logs, and other material which cross the trench and which might carry fire, are completely cut through and thrown considerable distance back into the burned area. Where a supply of water is available, the entire edge of the fire is wet down by using pails, hand or power pumps, and other mechanical equipment. This slows down the progress of the burning so that the work of extinguishing the fire goes on without the size of the fire increasing materially. If sufficient water can be reached within a distance of two or three thousand feet, the use of the power pump is, by far, the most practical method.

The term "surface fire" applies in most cases to all fires, since they all originate on the surface and may result in either a ground or

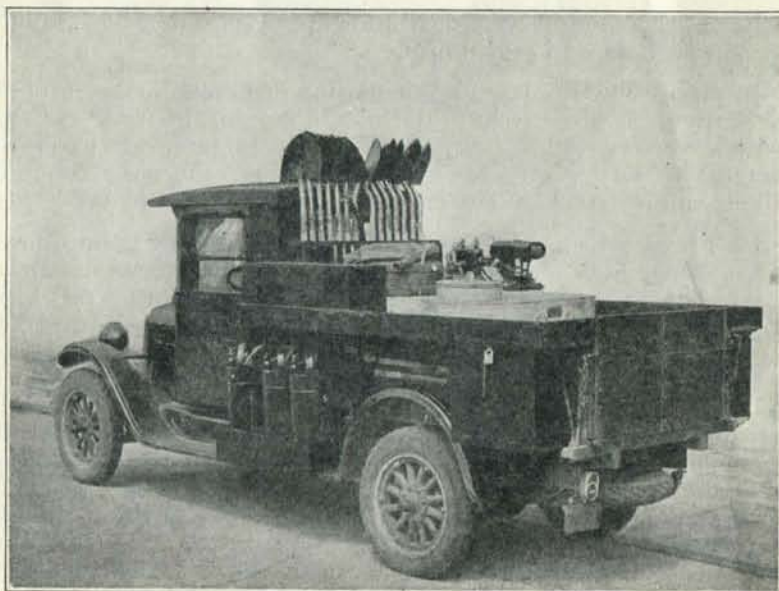


crown fire. It has been found that fire in a dense growth of grass, brush, or debris, can usually be extinguished by direct attack: throwing sand or water onto the edge of the fire either by hand or with mechanical equipment; or beating out the flames with wet sacks, brooms, boughs, etc. It is sometimes advisable, if conditions warrant such action, to plow a furrow as closely as possible to the edge of the fire and allow the fire to burn to the line thus formed.

A surface fire which jumps to the tree tops and advances rapidly through the crowns is the most difficult type of fire to check. Such fires occur on steep slopes or where the branches of the trees come close to the ground. They usually occur during periods of extremely high winds. During the day when high winds prevail, crown fires are fought by confining the fire-fighting activities to the flanks; but during the night, when the wind usually drops and the fire has decreased in intensity, the front of the fire line can be worked upon by trenching, back-firing, or other practical methods.

Setting back-fires is a dangerous practice and should never be attempted except by experienced fire-fighters, *and then only when all other methods fail.*

It is difficult to outline definitely actual methods of fighting fires, since each fire is an individual problem, and in most cases, is handled somewhat differently from other fires. For this reason experience is one of the necessary requirements in the supervision of the work.



*Fire Fighting Truck.*

During recent years the use of mechanical equipment has become more popular in fighting fire; and all types of machinery are used in Minnesota, from light-weight gasoline-driven pump units dispatching 15 or 20 gallons per minute, to large, heavy units handling as much as 300 gallons per minute. In addition to this, heavy tractors, plows, graders, etc., are also used where they can be transported into the fire area.

When selecting fire fighters, the ranger picks out the most experienced men in the locality as the initial crew by consulting his pre-arranged fire plan which consists of a set of maps, records, and field-books. After this supply of labor has been enlisted, he draws on hunters, fishermen, tourists, or any others frequenting the vicinity.

The law provides that any able-bodied citizen must assist in fire fighting when called upon to do so by an authorized forest officer. Rangers also have authority to commandeer automobiles and any other equipment which may be needed in fire protection work. Compensation in all cases must be paid by the state.

### Historic Fires

The following historic forest fires are still remembered in the United States; the list shows that Minnesota has had her share of them.

Date	Name of Fire	Location	Acres Area Burned	Lives Lost
1825—Oct.	Miramichi	New Brunswick .....	3,000,000	160
1837	Seboois	Maine .....	130,000	
1846	Yaquina	Oregon .....	450,000	
1853—May	Pontiac	Quebec .....	1,600,000	
1860	Nestucca	Oregon .....	320,000	
1868—Sept.	Coas	Oregon .....	300,000	
1868—Sept.	St. Helen	Washington and Oregon.....	300,000	
1871—Oct.	Peshtigo	Wisconsin .....	1,280,000	1,500
1871—Oct.	Michigan	Michigan .....	2,000,000	
1876	Big Horn	Wyoming .....	500,000	
1880—Sept.	Bagot	Quebec .....	288,000	
1881—Sept.	Michigan	Michigan .....	1,000,000	138
1891—May	Comstock	Wisconsin .....	64,000	
1894—July	Phillips	Wisconsin .....	100,000	13
1894—Sept.	Hinckley	Minnesota .....	160,000	418
1902—Sept.	Columbia	Oregon and Washington.....	604,000	18
1903—Apr.-June	Fernie	British Columbia .....	64,000	9
1908—Sept.	Chisholm	Minnesota .....	20,000	
1910—Aug.	Great Idaho	Idaho and Montana.....	2,000,000	85
1910—Oct.	Baudette	Minnesota .....	300,000	42
1918—Oct.	Cloquet- Moose-Lake	Minnesota .....	250,000	438





Map of Minnesota Forests and Ranger Stations.



## Slash Disposal:

Slash (or slashings) is a term applied to the leaves and branches of trees left in the woods after a logging operation. This slash or debris, if allowed to remain on an area, greatly increases the fire hazard. This is due to the fact that fire burns more intensely and is more difficult to control under these conditions. One of the most perplexing problems confronting the forest ranger is to determine the best method of slash disposal.

There is a law which relates to the disposal of slashings where no definite notice need be given by the forest ranger. This requires that "where timber is cut in, upon, or adjoining any forest land, and no specific directions are given by the forester for the disposal—all such slashings and debris within two hundred feet of any adjoining timber land or any public highway, railroad, portage, or lake shore shall be piled in separate and compact piles ready for burning immediately after said cutting is done and while the slashings are still green."

In all other cases the method of disposal is left to the judgment of the forest ranger, and he must give due notice of such method to the timber operator. These methods have been studied for many years, and they are still being improved. At the present time the following rules give the essential features of the slash policy for Minnesota:

### Privately Owned Lands:

(1) Do not burn logging slash by any method when there is any possibility of fires running, except to clear rights-of-way or building sites, and then only when sufficient men are present to handle the fire; the burning to be done under permit.

(2) Slash from heavy stands of pine, spruce, or balsam on high land shall be burned as cut, if in the winter; or well piled for later burning. Slash made between April 25th and October 15th should be piled and burned later. (These directions apply whether all the slash is to be burned, or only part of it.)

(3) In swamps very light slash may be lopped or left as cut. (Lopping means to spread slash over the forest floor and let it remain to decay and become humus.) Heavy slash may be winter burned (on snow), either as cutting progresses or in piles. In wet swamps no burning is necessary except around the edges and along fire lanes.

(4) On land likely to be soon cleared for agriculture, but not being cleared immediately, burn all slash for 200 feet around the sides, as made, and the remainder in piles or windrows when conditions are safe.

(5) Make all piles that are to be burned later at least fifty feet from living trees.

## State Owned Lands:

(1) All pine, highland spruce, and balsam shall be burned when cut except on summer operations, on scattered and light mixed stands, or in extremely isolated places. Disposal shall be under the direction of the district ranger.

(2) Swamp types—All heavy stands shall be winter-burned along main roads, logging roads, etc. The remainder shall be left, but piled or lopped as directed by the rangers.

(3) Swamp types—Light mixed stands and more or less isolated: Pile heaviest areas for burning; leave remainder; and lop if necessary. Pile everything 200 feet back along roads, trails, streams, or other areas traveled by the public.

(4) Where burning is ordered, it must be up-to-date with the cutting, and rangers are instructed to take legal action to compel strict observance to the requirement.

### Fire Prevention Rules:

1. Matches—Be sure your match is out. Break it in two before you throw it away.

2. Tobacco—Be sure that cigarettes, cigars, and pipe ashes are dead before throwing them away. Never throw them into grass, brush, leaves, needles, peat, or duff.

3. Making Camp—Before building a fire, scrape away all inflammable material from a spot five feet in diameter. Dig a hole in the center, and in it build your camp fire. Keep your fire small. Never build it against trees or logs or near brush.

4. Breaking Camp—Never break camp until your fire is out—dead out.

5. Extinguishing Camp Fire—Stir the coals while soaking them with water. Turn small sticks and drench both sides. Wet the ground around the fire. If you cannot get water, stir in earth and tread it down until packed tightly over and around the fire. Be sure the last spark is dead. Never bury a fire except with mineral soil.

6. Brush Burning—First get a burning permit from your local fire warden. Never burn brush piles or slash when there is the slightest danger that the fire will get away. Evening and night burning is the safest.

7. Report Fires—Put out all small fires you find in or near the woods. If it is too large for you to control, call the nearest telephone operator, and she will notify a forest ranger, patrolman, or fire warden.

8. Use your influence with friends and neighbors in promoting fire prevention. Do not hesitate to caution those who are not adhering to the rules of the woods.



## RAILWAY FIRE PREVENTION

Revised by Wm. M. Byrne

Assistant in Charge of Railway Fire Prevention

Most of the forest fires are started by some careless person. This may be done directly, such as throwing down a lighted match or going away without putting out his camp fire; or it may be done indirectly, by not taking the necessary precautions, such as running a sawmill engine or a locomotive without some kind of netting on the smoke stack to keep the sparks from getting out. Very few fires are set by lightning or other natural causes.

Years ago the people did not pay much attention to forest fires; however, they became so frequent and did such great damage that the state organized a Forestry Department to study the causes of fires and teach the people to be more careful. In the prevention of fires the railroad companies have a difficult task because hundreds of locomotives have to be run daily, no matter how dry the forests.

The locomotive is a complete power plant, that is: a boiler to make steam; an engine to use the steam; and wheels on which to run over the track and do work. It is tremendously powerful, and in order to produce this power it must burn great quantities of coal. It is not enough to have the same system of draught as we have for a furnace; this is not strong enough. In the locomotive a strong draught is produced by passing the exhaust steam from the cylinders up the stack. The coal is burned in the fire box and the hot gases pass through tubes to the front of the boiler and into a chamber called the smoke arch. In this smoke arch are placed plates and a large netting so arranged that all gases and pieces of coal sucked through the flues from the fire are screened; and no piece of coal larger than the openings in the netting can get out the stack. It can readily be seen that with such a strong draught many pieces of coal pass through the flues and are finally broken up in the smoke arch sufficiently small to pass through the netting. Unfortunately, when the weather conditions are extremely dry, even a small piece will sometimes set a fire.

There is another kind of spark arrester having no netting which is called a "Cyclone Spark Arrester." It is a big drum placed in the smoke arch under the stack. In the entrance to the drum, plates are placed at a slant, and in this way the hot gases and pieces of coal from the fire box are made to revolve inside the drum. Centrifugal force throws the pieces of coal against the walls of the drum, and they keep going around and around until ground up very small; they then pass out the stack.

In the fire box is an iron floor, called "grates," made up of many sections. These sections are full of holes which allow the air to pass

through. The fire is built on this iron floor. As the coal burns, small lighted pieces fall through the air openings. These have to be taken care of, and this is done by an ash pan. The ash pan is made as tight as possible; however, there must be openings to let in the air, called draught openings.

The draught openings in the pan must be well protected, as otherwise, a strong wind would lift coals out of the pan.

To lessen the danger of starting fires, the railroad companies clean up the ground which they own on each side of the track, called the right-of-way. All wood is picked up and burned, and each spring the grass on the right-of-way is burned over. This does not entirely prevent fires starting; however, a live coal would have to fall in exactly the right spot to start a fire with so little combustible matter present. Furthermore, if a fire did start, it would not burn fiercely, and one or two men would have a good chance of putting it out. In fire fighting it should always be kept in mind that the most effective action is to get to the fire when it is small. To accomplish this purpose the railroad companies have men traveling on little gas cars, called speeders, to follow the trains; when a fire starts, the men are there to put it out or to get more help if the fire is too big for them to control. These patrolmen carry, on the speeder, shovels and a water tank equipped with a hand pump. A small stream of water can be thrown twenty feet, and it is very effective in putting out fires.



The railroad section crews discover and put out many fires; when a large fire occurs, several section crews are called to put it out. The locomotive engineers, firemen, conductors, and station agents are all interested in fire prevention, and get word to the section foreman or patrolman when a fire occurs.



By very carefully building spark arresters on locomotives and inspecting them every trip they make, the number of fires set by locomotives has been greatly reduced. This, with the training of the company employees to extinguish quickly any fires set, has resulted in very little damage and small loss. There is a State Forest Service inspector who works closely with the companies and sees that the regulations agreed upon are lived up to.

### QUESTIONS

1. Why has so much of our valuable forests disappeared?
2. What was the greatest factor which caused the establishing of the Minnesota Forest Service?
3. What was the main weakness in the State Fire Wardens' organization?
4. What are the duties of a lookout towerman?
5. What is a crown fire? A ground fire?
6. Why is it dangerous to start a "back fire"?
7. Who may be pressed into service to fight fire?
8. Why is the disposal of slash important?
9. What are railway companies doing to aid in fire prevention?
10. What is a "spark arrester"?

### THINGS TO DO

1. Compare Minnesota's disastrous fires with those of Michigan and Wisconsin.
2. Locate the eighteen ranger districts on the map.
3. List the equipment found in a lookout tower.
4. Be able to discuss the three types of fires.
5. Give some rules for the disposal of slash.
6. List what you consider are the five most important fire prevention rules.
7. Explain the "Cyclone Spark Arrester."

### LIST OF REFERENCES FOR STUDY

- A Forest Fire Prevention Handbook for the Schools of Washington, USDA Misc. Pub. 20—Dist. Forester, Portland, Oregon.  
Oregon, USDA Misc. Pub. 20—Dist. Forester, Portland, Oregon.  
New Mexico, USDA Circ. 89M—Regional Forester, Albuquerque, New Mexico.  
Arizona, USDA Circ. 88—Regional Forester, Phoenix, Arizona.
- A Forest Fire Prevention Manual for the School Children of California, Bulletin 6, State Forester, Sacramento, California.
- Forest Fire Control—U. S. Forest Service, Washington, D. C.
- Forest Fire Prevention—U. S. Forest Service, Washington, D. C.
- Forest Fires in Maine—1916-1925, Bulletin 6, Maine Forest Service, Augusta, Maine.
- Forest Fires in South Carolina, Circular 77, Extension Service, Clemson College, South Carolina.
- Forestry and Forest Fires in Arkansas, Extension Circular 281, Arkansas Agricultural Extension Service, Little Rock, Ark.
- Six Rules for Preventing Fire in the Forests, American Forestry Association, Washington, D. C.
- The Destruction Caused by Forest Fires, Pub. 42, Virginia Forest Service, University, Virginia.
- The Lake Jovita Fire Club, Reprint, American Forestry Association, Washington, D. C.
- Woods Burning in the South, USDA Leaflet 40, USDA, Washington, D. C.
- Woods Fires Everyman's Enemy, Mississippi Forest Service, Jackson, Mississippi.