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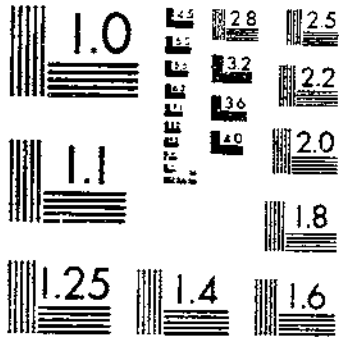
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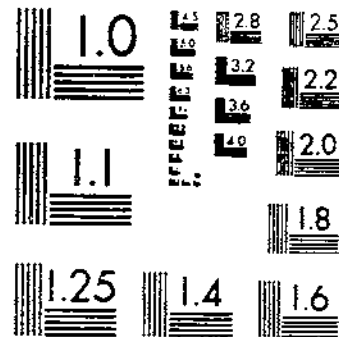
TO BURN WITH A MISEDAN TECHNICAL BULLETIN IN THE NORTH  
FOREST FIRE INSURANCE IN THE NORTHEASTERN STATES  
SHEPARD, H. B.

1905

# START



MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A



MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

## FOREWORD

This bulletin was in type and ready for printing when the great hurricane of September 21, 1938, struck the New England States. Over 2½ billion feet of timber were blown down, leaving the ground in many places encumbered with a tangle of trees and smaller debris. The forest-fire danger has been greatly increased throughout much of the northeastern white pine region. Somewhat less serious results occurred in the adjacent portions of the other regions covered in this bulletin, especially in Connecticut, Rhode Island, Massachusetts, and New Hampshire. The accompanying map on inside front cover gives a generalized picture of the situation.

One immediate consequence of the hurricane is to make insurance underwriting impracticable in the areas affected until normal conditions of fire danger, or conditions which approach those of the early part of 1938, are restored. Even then, the reduction of insurable values which has taken place may for a time be a handicap to successful underwriting.

Concerted efforts of the State forestry organizations, of the United States Forest Service, of other public agencies, and of the landowners immediately concerned are being directed to the salvaging of the down timber and the reduction of the fire hazard. It is impossible to predict at this time just how successful these efforts will be.

One mitigating circumstance connected with the hurricane disaster is already apparent. The attention of the New England States has been directed in a striking manner to the importance of trees in their economic and social organization. While many forest owners have suffered discouraging losses, public interest in forestry seems to have increased rather than diminished. It is possible, therefore, that forest values may be replaced more rapidly than past experience would lead one to expect.

Since the States of Maine, New York, Pennsylvania, Maryland, New Jersey, and Delaware were practically untouched by the hurricane, the findings of the study relating to these States remain unchanged. Sections of western Connecticut, Massachusetts, and Vermont were also little affected. Even in the hurricane area, the usefulness of this study is far from permanently impaired, since the principles and techniques developed are basic and therefore of lasting

interest and importance. The forest-insurance investigator, resurveying the problem in the Northeastern States in the future, will have his task much simplified with this bulletin as a guide. The description of forest regions, the general conclusions relative to the behavior of forest fires, their effects, and salvage possibilities, the detailed description of how the field work was done, the discussion of forest fire hazards, the presentation of recommended forest insurance forms, and the methods followed in constructing rating schedules are fundamental to the revival of interest in forest insurance that is certain to accompany the restoration of timber values. Recognizing, therefore, that the information which this bulletin presents is inapplicable for the time being over much of the northeastern pine region and for parts of the other regions, its publication at this time is deemed well worth while not only as a historical document but also as one of basic utility in the future.

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UNITED STATES DEPARTMENT OF AGRICULTURE  
WASHINGTON, D. C.

FOREST FIRE INSURANCE IN THE NORTH-  
EASTERN STATES<sup>1 2</sup>

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INTRODUCTION

This bulletin covers an inquiry into the practical possibilities of fire insurance for forest properties in the northeastern United States and follows the lines of an earlier study carried on in the Pacific Coast States, the results of which have already been published (?).<sup>3</sup> The purpose of the two studies is to establish the basic principles involved in forest fire insurance in all sections of the country. Detailed study of the fire-insurance aspects of two such large, widely separated, and greatly differing forest regions provides a broad basis for the practical application of insurance, even though further study may be profitably extended to other parts of the country as a phase of such practical application.

The Pacific coast report included a comprehensive discussion of such underlying considerations as the need for forest fire insurance in the United States, the lack of practical forest fire insurance facilities, and the possibilities arising in the development of forest fire

<sup>1</sup> Submitted for publication May 25, 1938.

<sup>2</sup> This study was conducted in 1934-37 while the author was assigned to the Northeastern Forest Experiment Station at New Haven, Conn.; the assistance of the research staff of that station and of the Allegheny Forest Experiment Station at Philadelphia is hereby acknowledged. Acknowledgment is due to many individuals and organizations for assistance rendered, among which may be mentioned especially the State foresters of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New York, and Pennsylvania; The Insurance Institute of America; the Insurance Society of New York; the National Fire Protection Association; and members of the Forest Service, both in administration and research.

<sup>3</sup> Italic numbers in parentheses refer to Literature Cited, p. 45.

protection. The principles of fire insurance as they apply to forest properties administratively and from the viewpoint of the under-

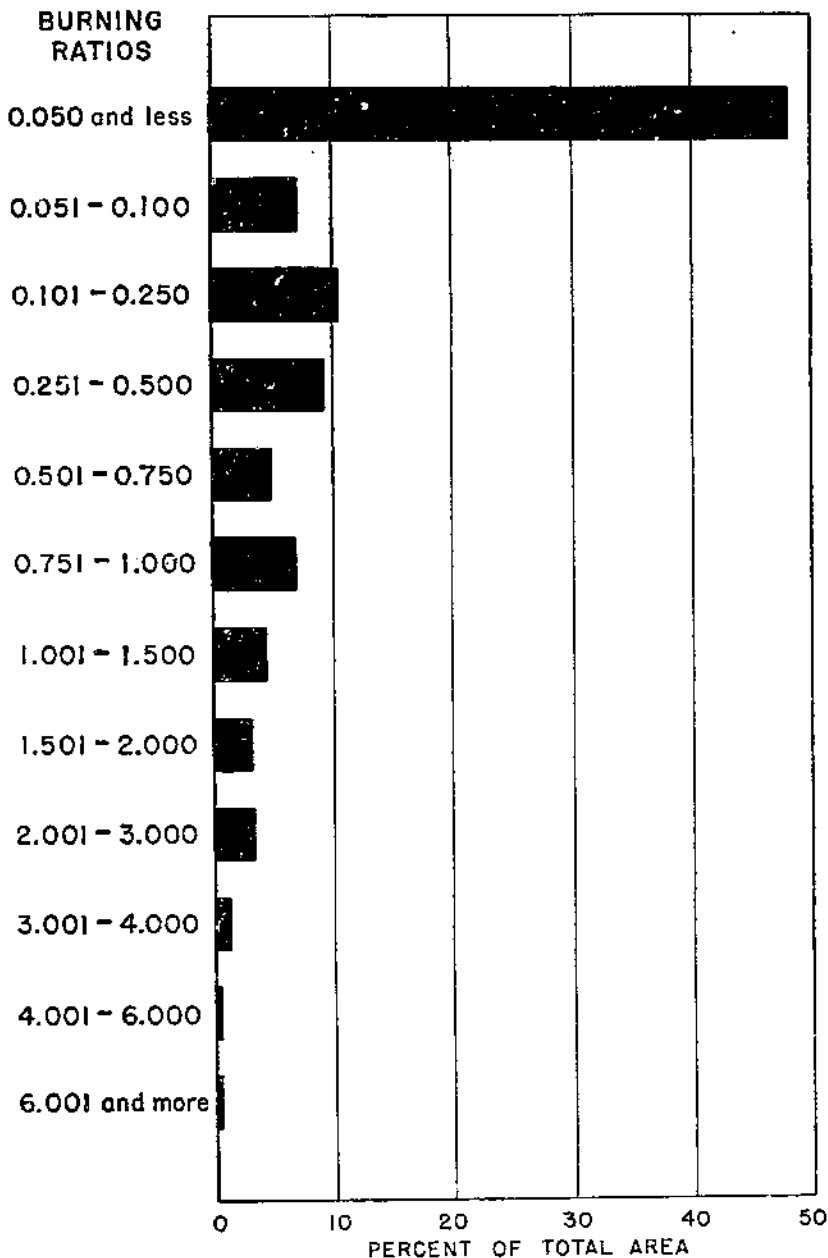


FIGURE 1.—Earning ratios by area of six sample States studied; as reported by State foresters. (Computed from integration of areas burned with forest land areas of individual political subdivisions.)

writer, and those of valuation and loss adjustment, were also discussed at considerable length. These discussions will not be repeated

here, since no significant differences are apparent with respect to these factors in the two regions.

The main objective of the study is identical in both regions—to ascertain as accurately as possible the conditions existing with respect to fire losses as they might affect an effort to provide forest owners with adequate fire insurance.

The conclusion drawn from the inquiry in the Northeast is substantially similar to that with respect to the Pacific Coast States; namely, that forest fire insurance is a perfectly feasible and profitable undertaking at very moderate cost to forest property owners, if proper precautions are observed. The normal annual loss expectation of the territory intensively studied is found to be, on a value basis, 0.135 percent. This figure includes a considerable area of relatively high hazard, much of which would undoubtedly be considered prohibitive by any well-ordered underwriting organization; but, on the other hand, as is indicated by figure 1, a very large aggregate area has a rate of loss well within the limits of conservative underwriting at very moderate rate levels. In nearly one-half of this territory, less than 0.051 percent by area is burned annually.

## TERRITORY COVERED BY STUDY

### GENERAL DESCRIPTION

Although this inquiry embraces the New England States, New York, New Jersey, Delaware, Pennsylvania, and Maryland, intensive work has necessarily been limited to a smaller territory. It was felt that principles could be sufficiently well established by study of a representative sample comprising Maine, New Hampshire, Vermont, Massachusetts, New York, and Pennsylvania.

In this most densely populated section of the country, most of the original forest was exploited many years ago. Although the present large forest area (table 1) consists mainly of second growth and is to some extent of doubtful value, the aggregate value in timber and forest growth is very large and the need for insurance protection is very real.

TABLE 1.—Total areas and forest-land areas of the New England and Middle Atlantic States

State	Total area <sup>1</sup>	Forest-land area <sup>2</sup>	
	Acres	Acres	Percent
<b>New England:</b>			
Maine.....	21, 145, 600	14, 567, 258	68.6
New Hampshire.....	5, 978, 240	4, 501, 800	75.3
Vermont.....	6, 120, 960	3, 282, 000	53.6
Massachusetts.....	5, 290, 240	3, 272, 487	61.9
Rhode Island.....	798, 720	270, 840	35.0
Connecticut.....	3, 177, 600	1, 590, 000	50.0
Total.....	42, 511, 360	27, 433, 385	64.5
<b>Middle Atlantic States:</b>			
New York.....	31, 490, 560	12, 017, 299	38.2
New Jersey.....	5, 263, 360	1, 999, 624	38.0
Pennsylvania.....	28, 880, 640	13, 206, 304	45.7
Delaware.....	1, 516, 800	325, 000	21.4
Maryland.....	7, 889, 280	2, 221, 971	28.2
Total.....	75, 040, 640	29, 770, 198	39.7
Aggregate.....	117, 552, 000	57, 203, 583	48.7

<sup>1</sup> Figures for total areas from Bureau of the Census, 1922.

<sup>2</sup> Figures for forest-land areas compiled by the Forest Service in 1931.



This 57.2 million acres of forest land can be classified, according to figures compiled by the Forest Service, into 54.4 million acres of commercial forest land; 2.6 million acres of noncommodity land capable of producing merchantable materials but legally reserved from commercial exploitation, as State and community parks; and 0.2 million acres of noncommercial land, not physically capable of producing merchantable materials, as swamps, bogs, and other areas where tree growth is stunted or deformed.

Of the 54.4 million acres of commercial forest land; 50.9 million is in private ownership; 0.8 million, in Federal; and 2.7 million, in State, county, and municipal ownership (8).

At the present time, the commercial category includes a type of forest land which, although it cannot properly be classified either as noncommodity or noncommercial, possesses little or no insurable value. This land, for a number of reasons, has fallen into the wasteland class. Inherently it is productive forest land. Actually it is not producing. Much of it gives no visible evidence at present of recovering productivity. It varies in character in the different regions and in localities within the regions but has the common characteristic throughout of mainly bearing worthless or near worthless growth such as inferior pitch pine, scrub oak, sweetfern, gray birch, aspen, and pin cherry. Almost invariably this class of land is relatively highly hazardous. Fires are common and constitute a large proportion of the reported forest fires in all the States. Actually they are not forest but brush fires and do not involve any insurable values.

The repeated burning of such lands, however, keeps them indefinitely nonproductive, and involves a loss of potential public economic values. Furthermore, they act as hazardous exposures to truly valuable and productive forests, generating vigorous fires and passing them on. It is this feature that most particularly justifies the effort and money expended on them for fire control.

Where such lands occur over extensive areas, as in southern New Jersey, Long Island, and Cape Cod, they were not considered insurable and no work was done on them in connection with this inquiry. On the other hand, when they occur in smaller tracts, scattered throughout the insurable forest areas, although causing no direct difficulty because of their extreme poverty in insurable values, they exert an adverse influence upon forest-insurance underwriting. Valuable properties exposed to them will inevitably be assessed higher premium rates because of this exposure. Fortunately, except in the sections mentioned above, this class of land occupies a relatively small area in comparison with the far larger extent of forest growth possessing insurable value.

Although much of the insurable value is subject only to relatively low hazards, none is entirely hazard-free. Serious and destructive fires may and do occur at times in all sections of the territory and in all types of forest growth. No forest owner can truthfully say that he has no need for insurance protection against fire. There is ample statistical indication that many of them are entitled to low premium rates and there is little likelihood that a forest-insurance project will succeed that does not comply with this requirement. Nevertheless, it appears that there is a real opportunity to obtain a large aggregate of premiums from the owners of such properties, with promise of success to an underwriting organization offering insurance on them.

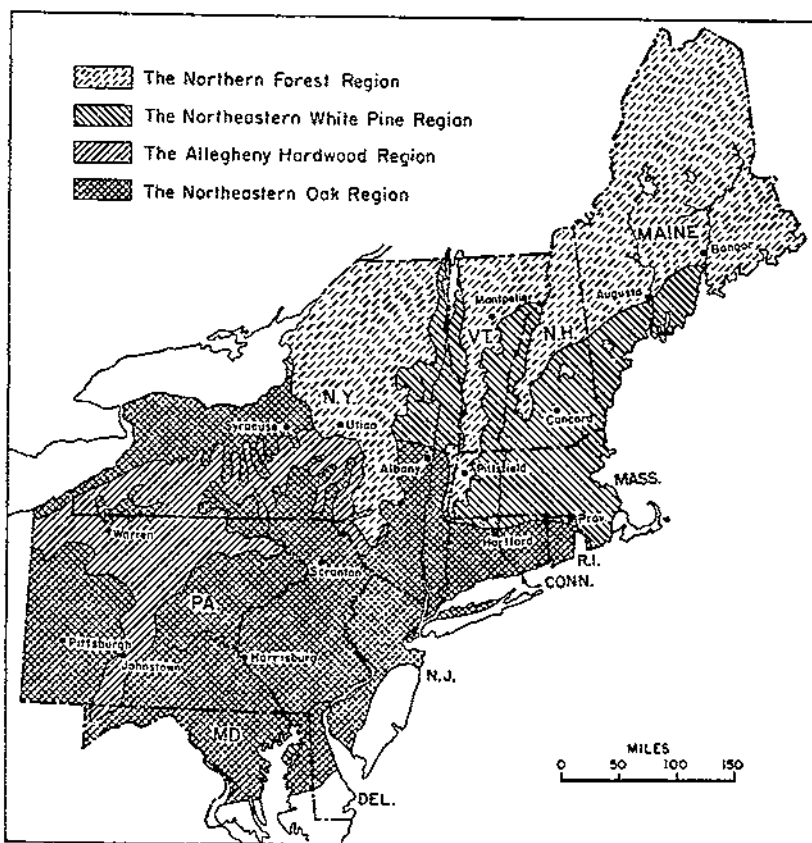


FIGURE 2.—Map of Northeastern States, showing the location of the four forest regions studied.

For practical purposes it is convenient to recognize in the northeastern United States four major silvical and economic regions: The northern forest, the northeastern white pine, the northeastern oak, and the Allegheny hardwood, located as shown in figure 2. Table 2 summarizes the forest-fire data on these regions as recorded by the individual States. Brief descriptions of them follow.

TABLE 2.—Summarized forest-fire data from 10-year experience, as reported by State foresters, by forest regions<sup>1</sup>

Silvical and economic division	Forest-land area <sup>2</sup>	Annual average				Average size of fires
		Fires	Fires per 100,000 acres	Area burned	Area burning ratio	
Northern forest.....	Acres 21,098,000	Number 447	Number 2.1	Acres 26,570	Percent 0.128	Acres 59
Northeastern white pine.....	10,242,000	1,847	18.0	34,749	.339	19
Northeastern oak.....	10,812,000	3,197	29.6	118,668	1.098	37
Allegheny hardwood.....	5,314,000	708	13.3	18,569	.349	26
Total.....	47,460,000	6,199	13.1	198,556	.418	32

<sup>1</sup> Excepting the portion falling in the pine and oak region along the coast from Cape Cod south.

<sup>2</sup> National-forest lands and metropolitan areas omitted. From figures furnished by State foresters.

## NORTHERN FOREST REGION

The northern forest region occupies the extreme north portions of the territory and the higher elevations in the north-central portion. In Maine it is the predominating region, occupying all except the southwestern portion of the State. It occupies the northern tip of New Hampshire and practically all of the White Mountain section; all of northern Vermont, extending southward through the Green Mountains to beyond the Massachusetts line. All of northern New York and practically the whole of the Adirondack Mountain section can only properly be designated as northern forest; also a considerable area in the Catskills.

Spruce and balsam fir of commercial size and quantity form the outstanding single characteristic of this region. Other conifers are white and red (Norway) pine, northern white cedar, hemlock, and larch (tamarack). Hardwood species are mainly sugar maple, yellow birch, and beech, with a considerable volume of white (paper) birch, aspen and other poplars, and red maple. A sprinkling of white and black ash, basswood, and some other hardwoods occurs too sparsely to be of much economic importance.

While the forest of this region is predominantly conifer, with large areas of practically pure conifer growth, there are also very considerable areas of practically pure hardwood, and uniformly so on the ridges in sections of rolling topography. Even in truly mountainous country, where the upper slopes are ordinarily covered by conifers—often practically pure spruce—the lower and middle slopes, like the ridges, are usually covered with hardwoods.

There is also, in the aggregate, a large area occupied by swamp and bog types. In these the growth is composed chiefly of northern white cedar, tamarack, spruce, red maple, and ash in varying mixtures. Here the water table is practically level with the surface with consequent unfavorable growing conditions. At best the forest is of relatively low value and much of such land possesses no timber value whatever.

The largest type in point of area is a mixed-growth type, sometimes called yellow birch-red spruce type. This is the most valuable type, not only because of its better growth capacity but because the most valuable commercial species predominate in it. In the original forest this type produced the largest trees and the best quality spruce and pine.

Because spruce was the most favored wood-pulp material during the early years of the present century, this period witnessed a spectacular growth of the pulp and paper industry in this region. It has overshadowed the lumber business in economic importance for many years and is today a highly important industry in the region. In some sections conversion of hardwoods for the manufacture of varied products, in recent years including pulp and paper, is also of great importance.

This region has long been a leader in recreational values. Noted for its cool summers, and retaining until very recently throughout much of its area a near-wilderness character, it has for many years attracted vacationists, fishermen, and hunters. This type of use has had very important effects on the fire history and has greatly influenced the development and administration of protection. In spite of the loss, within recent years, of some of its primeval character, the region

continues to draw recreationists in increasing numbers. There is no question but that, because of this, public education and other efforts at control of the recreation hazard, both direct and indirect, must be continued indefinitely.

While accessibility has increased markedly in much of the northern forest region in recent years, it still remains considerably less accessible than most of the rest of the territory. Its chief characteristic is consequently a relatively small number of fires of relatively large average size, as indicated in table 2.

Physical fire hazards are quite generally severe and such fires as occur are highly destructive in practically all types. The fire season is usually long, lasting more or less unbrokenly in normal seasons from the middle of May until the first of October. In spite of these disadvantages the protective organizations of all the States have, over a long period of years and over the region as a whole, held the average annual losses to very nominal figures. A few sections appear on the record to be, for one reason or another, almost prohibitively hazardous, not because of extreme natural conditions, but because protection has not kept up with causative and contributive hazard conditions created by exploitation or recreational use. Forest fire insurance underwriting will encounter problems in the region and will require a certain degree of skill. It will by no means be unduly difficult, however, for persons thoroughly acquainted with the region and its hazards. The region can be expected to produce, with entire success, a considerable amount of forest fire insurance business.

#### NORTHEASTERN WHITE PINE REGION

Generally speaking, the northeastern white pine type group occupies a transition belt between the northern forest and those of the North Atlantic and Central Atlantic States. In this belt, white pine is one of the commonest trees and practically everywhere conspicuous. Although it by no means has an economic or silvical monopoly, it is by far the most important conifer in the region. For a time, following the reversion of abandoned farms to forest, it occupied a very large share of the land in practically pure old-field stands.

Lying between the oak region and the northern forest region, the northeastern white pine region contains considerable quantities of the hardwood species characteristic of both. Toward the north, beech, birch, and maple become increasingly important while toward the south the oaks and hickories tend to predominate. In many localities white ash produces good-quality material in considerable quantities. Although a tendency to regard hemlock as inferior still persists, this species nevertheless yields a product of real economic importance in the region.

Starting with a strip approximately 30 miles wide running southwesterly from the Penobscot River, the northeastern white pine region occupies all of New Hampshire south of the White Mountains, the lower elevations in southern and central Vermont on both sides of the Green Mountains, all of Massachusetts except Cape Cod and the Berkshire Hills, and a strip 10 to 50 miles wide along the eastern boundary of New York.

Man is undoubtedly responsible for the modification of the original forest of mixed conifers and hardwoods, in which oaks, chestnut, and white pine predominated. The region today bears a large aggregate

of nearly pure hardwood growth of mediocre quality, much of which is of sprout origin, considerable areas of old-field white pine in practically pure stands, some high-quality forests principally of seed origin and mainly of the mixed type, and some unproductive areas occupied largely by scrub oak, gray birch, and other brushy species and pitch pine. The common practice of clear cutting creates a condition under which a considerable portion is in a cut-over or regeneration stage.

This region includes some of the most densely populated sections of the country, a fact that inevitably results in a moderate to high fire hazard because of the large numbers of fires started. In addition, the common forest types are of relatively high inflammability. Some fires in the white pine region kill all the trees on the area affected. In many instances, however, the damage is comparatively light and partial. Because of topographic conditions and the resistance of some of the native species, the average destructiveness of fires is less here than in the northern forest region.

The principal fire season in this region comes in the spring, before green vegetation and tree foliage have developed, and when the cumulative effect of low relative humidities is greatest. After the middle of May there is ordinarily a marked drop in hazard, and such fires as may occur during the summer are of minor importance. A secondary fire season ordinarily comes in the fall when the green vegetation begins to die. Dry falls sometimes produce very bad fire seasons with serious damage, but this hazard rarely persists after the middle of November.

Some areas, subject to frequent and serious fires, are prohibitively hazardous for forest fire insurance. In other areas liability should only be accepted subject to careful underwriting. In all sections, however, are many areas with large aggregate forest values subject to very moderate or low hazards, where fire insurance can safely be placed at low premium rates. Properly handled, the region is capable of producing a large volume of profitable business.

#### NORTHEASTERN OAK REGION

With unimportant exceptions the forests of the northeastern oak region are composed largely of various species of oak mixed somewhat with hickory, ash, maple, beech, and other hardwoods of less silvical and economic importance, and with hemlock, pitch pine, and locally a sprinkling of white pine. Toward the south, Virginia scrub, shortleaf, and loblolly pines begin to appear. Red cedar occurs scatteringly in commercial sizes and quantities.

The northeastern oak region occupies practically all of Connecticut and Rhode Island, northwestern New York, particularly along the shore of Lake Ontario, and much of the southeastern part of that State, as well as all of northern and western New Jersey, northern Delaware, practically all of Pennsylvania except the highlands of the north and northwest portion, and northern Maryland.

This region is characterized by a high degree of uniformity of forest type as it affects fire hazard. There are variations in the mixture of the different species of oak, light to medium admixture of pitch pine in parts of Pennsylvania, local mixtures of hemlock and white pine, and a moderate aggregate of Virginia scrub pine type, relatively pure. With the exception of the more hazardous Virginia pine type, there is

little practical difference in fire hazard due to difference in forest type. Everywhere, however, are considerable or extensive areas substantially nonproductive, occupied by scrub oak and other brushy, noncommercial species, resulting largely from the clear-cutting of former commercial forest stands. These, like the waste areas in the white pine region, are highly hazardous and burn frequently. Their threat to a forest fire insurance project is that in generating strongly running fire they may pass it on to areas that bear insurable growth. They must consequently be given serious consideration in the administration of forest fire protection and insurance.

Clear-cutting is the usual practice in this region also. Forest products serve a variety of purposes, from fuel wood to sawed lumber for remanufacture into many hardwood products. Railroad ties, poles, and posts are important products, and in Pennsylvania the forest is continually called upon for mine timbers.

These forests, like those of the white pine region, are accessible to a dense population, which exerts a marked influence on fire-loss experience. This is particularly true in southeastern New York and the hard-coal district of Pennsylvania, where fire losses are in the aggregate higher than in any other northeastern section of comparable size. The fire seasons—principally in the spring and secondarily in the fall—are very similar to those in the white pine region farther north and of about the same normal duration. Here, too, the summer is a season of minor fire importance, although summer droughts may result in occasional losses.

This region, like the others, is capable of supporting a large volume of profitable forest-insurance business at reasonable rates. There are some prohibitive sections, a few of considerable extent, and careful underwriting would be called for in a number of other sections. Properly undertaken, forest fire insurance can succeed here and serve a useful economic and social purpose.

#### ALLEGHENY HARDWOOD REGION

The Allegheny hardwood region is quite like much of the northern forest region except that there is no spruce or fir in commercial quantities. The principal species are hard maple, beech, yellow and black birch, and black cherry, in mixture with white ash, basswood, cucumber, yellow poplar, and a number of hardwood species of less silvical and economic importance. Hemlock is the leading conifer. There are also some white and other pines. Most of the white pine occurs in pure stands.

The virgin forests of this region were richly productive of high-quality timber of valuable species, notably white pine. For a number of years, in the latter part of the nineteenth century, the exploitation of these values constituted an important industry, particularly in Pennsylvania.

An outstanding feature of the Allegheny hardwoods is low fire hazard. The forest types are relatively low in inflammability and the population contact is generally low. The effect of these conditions is apparent in the region's fire history. Destructive fires occur with a frequency that requires insurance, but underwriting will be very simple and premium rates properly very low. This region will unquestionably deserve liberal treatment and low insurance costs.

What has been said of the fire seasons of the northeastern oak and the pine region is substantially true here. Spring and fall are the truly troublesome times, spring somewhat the worse.

Excessive exploitation has, in much of this region, considerably reduced the density and quality of the forest growth below best standards of productivity and value. There is nevertheless a considerable industry the products of which are substantially similar to those of the northeastern oak region. Some localities have escaped heavy cutting and still retain forests with good growing stocks, capable of producing high-quality materials in considerable quantities.

It should be possible to develop a considerable volume of desirable forest fire insurance business in this region.

#### INSURABLE VALUES IN ALL REGIONS

Insurable values in the four forest regions covered by the study have been conservatively estimated as follows:

Northern forest.....	\$233, 000, 000
Northeastern white pine.....	116, 000, 000
Northeastern oak.....	156, 000, 000
Allegheny hardwood.....	88, 000, 000
Total.....	593, 000, 000

These values express the condition existing in the territory today, with most of the forest partially depleted. As better forest management is practiced the capital values of the forests will increase materially. The land is unquestionably capable of maintaining production on a scale of capital values three or four times as great as those prevailing. Successful fire insurance will play a positive part in encouraging better forest management, and in helping toward the development of greater forest values, with corresponding increases in insurable values. Dana (2) and Behre and Lockard (1) have written at considerable length on the possibilities of improved forest management in the Northeast.

#### METHOD OF STUDY

A major requirement of this study is the identification and evaluation of the factors of hazard involved in practical rating and underwriting. This requirement includes (1) determining extent and character of losses; (2) identifying, evaluating, and classifying hazard factors; (3) determining the values subject to loss from single fires; and (4) estimating the quantity of business possible under the required rating and underwriting principles as laid down in this study.

The inquiry utilized all available data from all privately owned lands, obtaining the widest possible statistical base in this ownership class. While the general conclusions can thus be accepted as reliable indications of conditions in the territory as a whole they cannot be taken as applying to any specific part, the portion that might be insured, for example. This consideration, together with the moral hazard, inevitably takes the final conclusions of the study quite definitely out of the field of precise science. There is no help for this. Provision for the lack can be made only through the introduction of some factors of safety in rating and underwriting, and, as a final phase of the inquiry, by an exhaustive study of probable demand.

It is essential that the factors of safety be applied intelligently and without imposing prohibitive conditions.

To determine the general extent of losses, recourse was had to the mass of data embodied in the individual fire reports of the local wardens and rangers for 10 years back. Obviously, insofar as these records are reasonably accurate they form a basis for the essential structure of statistical data.

The first activity of the study was accordingly the collection and organization of the experience data supplied by the foresters' offices of the six sample States. The second major activity was the collection in the field of a quantity of loss data that could be used to check the accuracy of the fire reports. These data were much more intensive in character than those from the fire reports and therefore served not only as a check but also as a means of supplementing and refining the sum total of data. They also gave valuable insight into fire behavior and the identification of hazard factors.

The precise evaluation of fire hazards is, of course, impossible. They are far too numerous and erratic in their action and they act in such an infinity of combinations that statistical analysis of their influences is impossible. Nevertheless, painstaking observation of them followed by logical organization of the results permits an evaluation sufficiently accurate for the purposes of fire insurance. As time goes on and more observations are made, more perfect systems of rating and underwriting will be possible.

Determining the average aggregate of loss is not, of course, sufficient for rating and underwriting purposes. Many variables must be recognized and their effects provided for. Some of these variables, like the individual experiences of towns, are easily measured in most of the Northeastern States. This gives at once a definite indication of where the worst, best, and intermediate loss conditions are and makes possible a useful system of classification.

In any practical rating system it is necessary to provide for variation introduced by certain hazard factors. It is obvious that slash increases the hazard, but an attempt to estimate this mathematically under any given set of conditions would require the collection and refinement of a large quantity of data very difficult to get and weigh. Some of the provisions in the schedules of rates as suggested are therefore only rational recognitions of known variables.

Some of these rationalized allowances are modifications of the findings of the Pacific coast study. In that work, the intensive analyses of part of the territory by the forest survey made possible relatively accurate weightings of a number of specific fire hazards. Since the general nature of hazard is constant, regardless of locality or special condition, better expressions can be derived through combining western and northeastern data than would be possible from the less intensive northeastern data alone.

The rating and underwriting principles suggested here will serve all practical requirements during the introductory and trial period of forest fire insurance in the northeastern territory; and in time the results of experience will furnish authoritative criteria for modification, refinement, and improvement.

In carrying on the investigative work it was not necessary to vary the method from region to region. The general basic conditions, social, economic, and political, are essentially similar throughout the



territory and the differences in forest and forest-fire conditions are insufficient to require differences in the method of work.

#### DETAILED FIELD ANALYSIS

The work of the detailed field analysis followed closely the principles and methods established in the Pacific Coast States. With a complete list in hand of all of the fires 50 acres or more in size that had occurred within the past 3 years, the field party set out to make complete analyses of as many as possible of the resulting burns.

The chief objective was the accurate determination of the exact consequences of the fire, the forest types and age classes involved, the hazard factors which operated, such as slash, adverse topography, or deficient protection, and a quantitative expression not only of the damage done by the fire but also of the damage it might have done but did not.

Field parties, on arrival at a new locality, first contacted the local warden, ranger, or other forest officer, who with his men could locate the burned areas most quickly and accurately. A word of appreciation is due these men. They not only knew their work and their territories extremely well but were most cooperative. Without their aid the work would have been much more difficult.

A brief general reconnaissance of the burned area was first made as the basis for a rough cruising plan. Then followed a gridironing of the area with cruise lines spaced according to the size of the burn. If the burn was believed to cover less than 50 acres the cruise lines were run five chains apart. On burns of 50 to 350 acres 10-chain intervals were used; on 350- to 3,500-acre burns, 20-chain intervals; 3,500 to 35,000 acres,  $\frac{1}{2}$ -mile intervals; and more than 35,000 acres, 1 mile.

Regardless of the spacing of the lines,  $\frac{1}{4}$ -acre sample plots were taken at five-chain intervals on the lines. On these plots all saw-timber trees (conifers 6 inches and over d. b. h.,<sup>4</sup> and hardwoods 10 inches and over d. b. h.) and cordwood trees (hardwoods 3 inches and more but less than 10 inches d. b. h.) were recorded by species, diameter at breast height, and condition with respect to fire damage; that is, whether killed by the fire or left alive. The saw-timber trees were recorded individually, but cordwood trees were recorded by number of trees and average diameter at breast height, thus: 100 per acre, 4 inches d. b. h. All conifer species were recorded individually, but hardwoods were grouped together.

Trees were termed "alive" if it was clearly apparent that they were not dead and were not going to die as a result of the fire. This does not mean that they were entirely undamaged. The allowance for partial damage was, however, not a part of the field work. This will be discussed in detail further on in the report. To allow a margin of safety, all doubtful trees were recorded as dead even though they were still green.

Enough tree heights were measured in the different diameter classes on each burn to give definite indications of the prevailing heights of each species and to insure adequate control of this element.

Unmerchantable growth was recorded by a modification of the so-called stocked-quadrat method, as described in detail in the previous bulletin (?).

<sup>4</sup>D. b. h. = diameter at breast height (4.5 feet).



chantable, light burn. Types were recorded according to a number of designations intentionally kept as simple as possible. Among the more important are mixed growth, hardwood, pine, spruce, and mixed conifer.

In addition to the map data on forest types, all areas of brush, waste, or other nonproductive but essentially forest land were also recorded. Grass areas not essentially forest land were neither mapped nor recorded. Figure 3 shows a completed field-analysis map.

In all, the field analyses covered 146 separate burned areas with a total area of 103,382 acres. These burns were widely distributed and can therefore be accepted as contributing an entirely acceptable sample. Table 3 shows the distribution between the four forest regions and the six sample States.

TABLE 3.—Burned areas covered by field-analysis work by forest regions and State

Forest region or State	Burns cruised		Area	
	Number	Percent	Acres	Percent
Northern forest.....	24	16	77,882	75
Northeastern white pine.....	44	30	6,247	6
Northeastern oak.....	71	49	18,369	18
Allegheny hardwood.....	7	5	854	1
Total.....	146	100	103,382	100
Maine.....	12	8	70,327	68
New Hampshire.....	13	9	2,150	2
Vermont.....	10	7	210	—
Massachusetts.....	20	14	3,614	4
New York.....	35	24	11,787	11
Pennsylvania.....	56	38	15,294	15
Total.....	146	100	103,382	100

Although the burned areas were selected from fire records of the 3 years previous, the greater number of those analyzed were from fires of the previous year. These offered the best working conditions. Burned areas 2 years old offer only slightly greater difficulty, however, and in many cases it is entirely practical to work upon areas 3 years old. It is never practical to attempt to analyze damage on areas burned during the current year. At least 1 year must elapse to permit the effects of the fire to become sufficiently apparent.

Since the sizes of the trees and the commercial standards of merchantability were substantially the same in all the forest regions of the Northeast, the methods of recording data, region to region, were not varied. Broadly speaking, also, a single type-classification system served throughout.

The philosophy, findings, and application of the field-analysis work are treated in detail in the discussion of the construction of the rating schedule.

## CONTRIBUTIVE FOREST FIRE HAZARDS

### PHYSICAL HAZARDS

Contributive fire hazards are those which affect the spread of fire or the seriousness of its consequences. They occupy a wide range of character and influence from the natural resistance of a forest tree to

heat and fire damage, to the artificial, man-created aid to fire represented by dry logging slash.

The effort was made to uncover all physical-hazard factors that must be taken into account in any practical rating and underwriting. It was obvious that some elements were identical with those encountered in the West. The two elements cited above are, in fact, universal and will be met wherever in the civilized world there are forests and forest fires.

As the study progressed it became increasingly apparent that fewer rather than more physical-hazard factors would require recognition in the Northeast than on the Pacific coast. This is a welcome feature, for simplicity is always desirable in insurance rate making. The essential factors in the Northeast are (1) a broad classification of the stand as between hardwoods and softwoods; (2) the size class of the majority of the trees in the stand; (3) whether or not there is exposure to slash or to previously burned lands, waste or brush areas, or other dry and hazardous types, or commercial blueberry lands; (4) dead or dying timber in the stand; and (5) natural or artificial firebreaks (fire lines, rivers, lakes, cultivated fields, etc.).

It is apparent that no data could be collected that would accurately express weights and consequences of these five physical conditions statistically. Expressions given in the suggested rating schedule are accordingly rationalized, on the basis of the best evidence available, including the testimonies of experienced firemen and forest officers, the observations of forest-fire research workers, the observations gleaned in the course of the inquiry itself, and the evidence produced by the study in the Pacific coast territory where the work of the forest survey made possible a relatively precise weighting of some of the factors involved.

It is believed that the recommendations herein will serve adequately the purposes of introductory and trial forest fire insurance practice in the Northeast. Since subsequent experience will undoubtedly clarify the problem and point to some desirable modifications, provision should be made in the course of actual insurance practice for the collection and analysis of all available data.

#### CLIMATIC HAZARD

A considerable amount of time was spent on an analysis of weather data from which the conclusion was drawn that it will not be advisable to attempt to delineate zones of climatic variation for forest fire insurance purposes in the territory as was done in the West.

There are obvious differences in the year-round climate within the territory; that of southern Pennsylvania bears little resemblance to that of northern Maine. The only factors of fire-season climate for which reliable data are available are volume and distribution of precipitation, and temperature. An analysis of temperature records without adequate data on relative humidities or rates of evaporation is inconclusive.

There are slight zonal variations in volume of precipitation received during the fire season within the territory but careful study of these, together with consideration of other hazard factors, indicated that there is no need to provide for separate climatic charges in rate making. Furthermore, as will be explained in subsequent discussion, the sug-

gested rating plan provides for classification of local divisions with respect to general hazard factors, of which fire-season climate is one. This is believed to provide adequately for the climatic factor and no further treatment of it is recommended.

#### EFFECTIVENESS OF PROTECTION

Although protection as a fire hazard is negative in its effect, it is possible by establishing a standard of best possible protection to measure deficient protection as a positive hazard, which in truth it is.

It became early apparent that such a measurement is peculiarly adapted to the physical, social, political, and economic conditions existing in the Northeast. New England is a stronghold of decentralization, individuality, and local independence. Throughout much of the territory protection is administered by the local political units, or towns. As there are upward of 1,200 of these independent local units in New England, New Hampshire, Vermont, and Massachusetts alone, it is clear that inspecting their forest-protection forces for the purpose of grading them or even of discovering a standard would be a hopelessly long job for this inquiry. Fortunately, the availability of the reported fire-loss experiences of the individual towns, in terms of forest areas burned annually, as well as areas of forest lands at risk in each town, made such an effort unnecessary. Comparing the average area burned annually for a period of years with the total forest-land area of a town produces a figure that can be used as a rough basis for classifying that town with respect to its recent fire history, and therefore according to its apparent loss expectation.

It is realized that such a method, if applied indiscriminately, would work injustice in certain cases. A town occasionally incurs severe losses from single fires which are due not so much to conditions peculiar to that town as to the chance development of special combinations of circumstances. Such a development is really an element of conflagration hazard and should not be charged to that town alone but must be absorbed by all towns sufficiently similar to be threatened with a like experience. The handling of this adjustment is discussed in detail further on.

Again, some towns that have adverse records as the result of a series of fires distributed through a period of years are found to be subject to some especially adverse condition in the nature of a localized hazard that causes practically all of the fires to be repeated burnings of substantially the same area. Where this is the case it is of course not fair to penalize the owners of properties that are really enjoying adequate protection and a favorable loss experience, particularly if their exposure to the hazardous area is remote. In these cases the excess hazard should be absorbed entirely in the high-hazard area, which will thus probably be not insurable. Ordinarily such areas do not possess insurable values.

Where neither of the above-described conditions exists and a town is plainly subject to relatively frequent and serious losses, property owners must be asked to pay higher premium rates for their insurance. In extreme cases, prudent underwriters will decline liability in all parts of the town.

This process of classification comprised a major activity of the inquiry. Figure 4 shows the towns in Massachusetts according to the

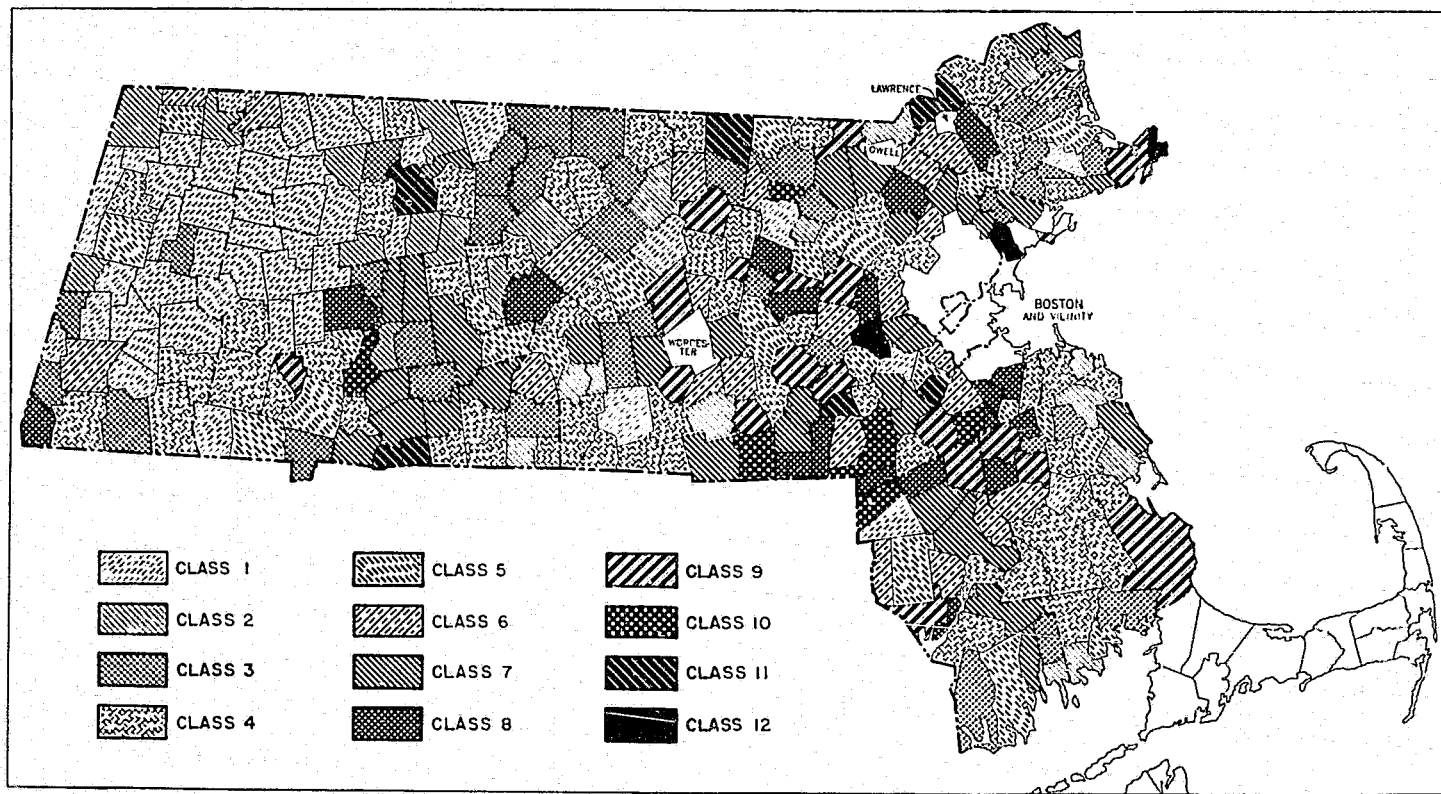


FIGURE 4.—Classification of Massachusetts towns by forest-fire experience for the 10-year period 1925-34, in percent of forest-land area burned, the lighter symbols indicating the more favorable conditions.

ratio of forest land burned during the decade studied. Figure 5 shows the classification adapted for rating purposes, giving consideration to the circumstances, as explained above. This method provides a logical and practical method of providing for allowance for the more general hazard conditions. The principle is more fully explained in the section dealing with the construction of the rating schedule.

In some parts of the territory that were intensively studied, protection is not a local town affair but is administered by the States under the district system. This condition exists in the so-called forestry district of Maine, in much of New York, and throughout Pennsylvania. There are some legal and administrative differences but they are of minor importance for purposes of this discussion. Pamphlets issued by the State conservation departments give information as to the protection laws and provisions covering this district organization (3, 6).

Where forest-fire protection is chiefly a town affair, as in Massachusetts, New Hampshire, Vermont, and that portion of Maine outside the forestry district, the ordinary procedure is the appointment by the selectmen or mayor of a town fire warden. These wardens are assisted by lookout systems maintained by the States to discover and report fires. In Massachusetts and New Hampshire the States also maintain district systems superimposed upon the town protection organization. These districts are in charge of district wardens who maintain equipment and apparatus to be used in cooperating with the towns in forest-fire fighting, and to effect better coordination in the whole protection effort. The detailed legal and administrative features of these district organizations are set forth in pamphlets published by the States (4, 5, 9).

The Maine law provides for the appointment, under local option, of county wardens, so-called, who act as intermediaries between the town organizations and the State system, affording cooperation and strengthened support on the district principle. Not all of the counties have availed themselves of the opportunity to have this county warden system established.

All of the State cooperation in forest-fire protection functions under authority of the Clarke-McNary law passed in 1924 and directed toward a general countrywide strengthening of forest-fire protection. Under this law, States which comply with established requirements receive financial aid from the Federal Government.

Associations, formed by the banding together of the owners of contiguous or near-contiguous properties for fire protection were at one time an important factor. In recent years, with the extension and improvement of public and semipublic protection, they have been less needed. A few are still in active operation, however, supplementing or relieving to some extent the public responsibility. Where this is the case appropriate adjustments are made in the sharing of the cost.

Throughout New Hampshire, Vermont, Massachusetts, and Pennsylvania public protection, financed by appropriation from the general tax levies, is provided. This is also largely true in the portion of Maine that lies outside the forestry district. In the forestry district of Maine a special fire-protection tax is collected by the State, the

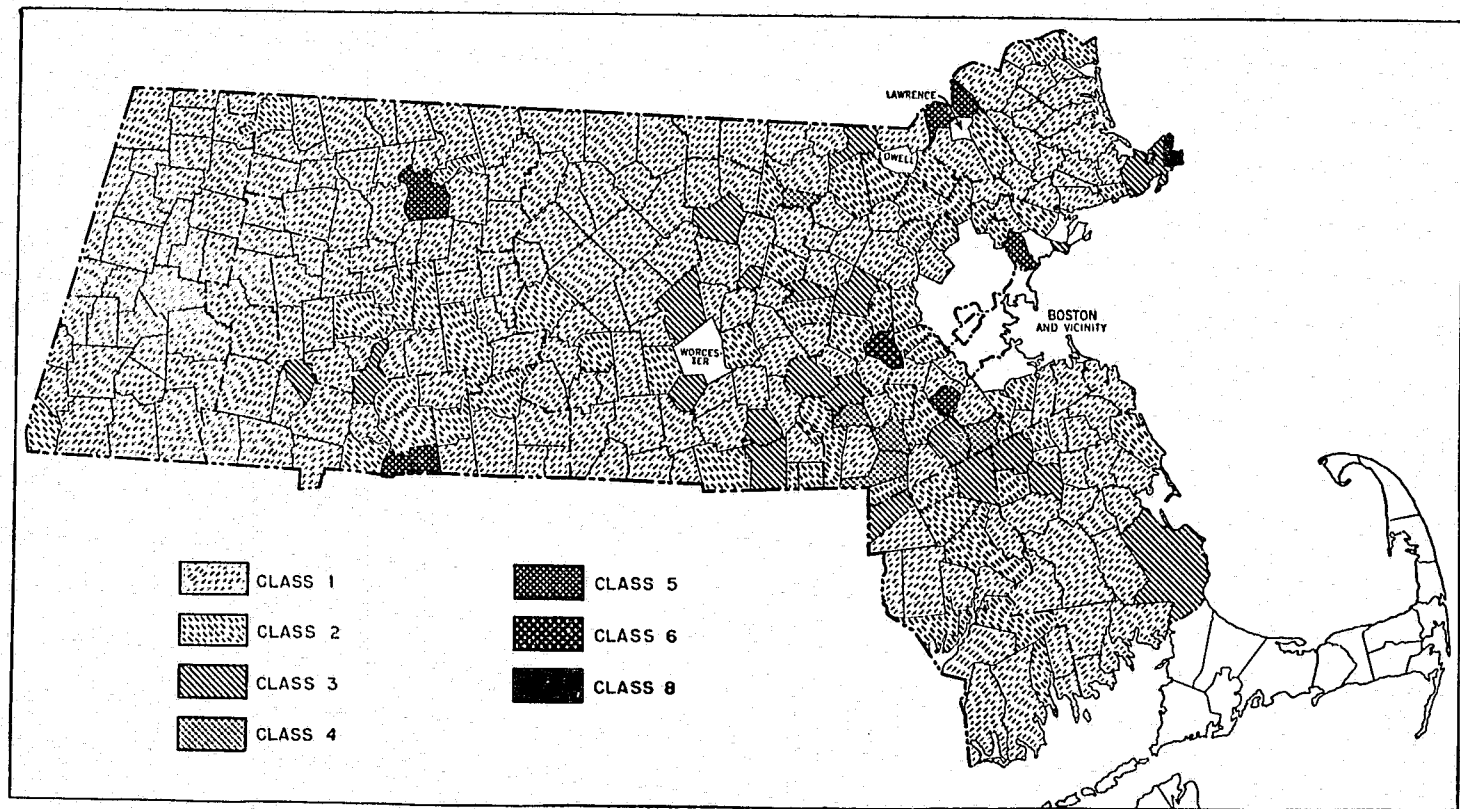


FIGURE 5.—Adjusted classification of Massachusetts towns for rating purposes. No town happens to fall into class 4 in this State. Here, as in figure 7, class 1 is the most favorable.



proceeds of which are used solely for financing the cost of protection in the district. This makes the forestry district in essence a large compulsory protective association administered by the State. Some of the landowners go to the expense of maintaining their own private patrols and protection equipment in addition to that supplied by the State under the general law. The C. C. organization has been of great value in the forest-protection effort. Not only are the boys called out to help fight large fires, but a permanent fire detail is maintained in most camps.

#### CAUSATIVE FOREST FIRE HAZARDS

Causative hazards are those that start fires but have no influence on their spread or consequences. After careful investigation it is evident that causative hazards in the Northeast do not necessitate any undue complication of the rating and underwriting systems. It is also apparent that the causative hazards operating in this territory are the same as those operating on the Pacific coast. Some of the recognizable causes in the Northeast—such as recreation and lightning—give indication of so little variation with geographic location, that no account needs to be taken of them. Differentiation was required with respect to both of these causes in parts of the West.

Investigation also indicated clearly that no statistical analysis will give a practical indication of the quantitative internal variations resulting from local operation of causative hazards. It is obvious that logging operations increase the hazard in exposed forest growth. A quantitative expression of this hazard increase would require not only knowing how many fires are started by logging operations (a relatively easy determination) but how much forest value is exposed. Determining the exposure in any forest region or State for a sufficiently long period would be an extremely costly and uncertain effort, definitely prohibitive to the current work. All that can be done for the present is to apply judgment allowances based on the general fund of knowledge acquired by the inquiry and checked by the testimony of experienced fire fighters, administrators, and research workers.

The recommendations of the inquiry have been arrived at in this manner. They are not presented as ideal or the last word in rating principles but it is confidently believed that the methods suggested will serve adequately during the trial period. As is true of all the suggestions, time and experience will furnish a basis for improvement. Causative hazards in their application to actual hazard rating in the territory are discussed in more detail in connection with the construction of the rating schedule.

#### CONFLAGRATION HAZARD

As in the West, two types of conflagration hazard can be recognized—that arising from major conflagrations, or abnormally large fires occurring only once in 25 to 50 years, and that due to what may properly be considered as minor conflagrations. It is believed that the most satisfactory handling is to define these two conflagration stages in terms of areas burned, since a minor conflagration in some localities would be relatively a major conflagration in others. In the Northeast, a 25,000-acre forest fire is a case in point. In the forestry

district of Maine any 10-year experience can be quite definitely counted upon to produce a few fires of approximately this size, so that here such a fire can hardly be called a major conflagration. On the other hand, in the more thickly settled white pine region, where forest areas are much more broken, a 25,000-acre fire is almost a physical impossibility, or at most of such extreme rarity as to qualify unquestionably as a major catastrophe.

It is advisable, therefore, to divide the territory into two general conflagration classes—major and minor. Specifically, the major conflagration area covers the forestry district of Maine and some of the towns just outside; the Adirondack and Catskill sections of New York; Coos County in New Hampshire; and the main range of the Green Mountains in Vermont.

In 1934 the forestry district of Maine had a major conflagration of approximately 50,000 acres, the largest fire in the State (and in the Northeast) since 1910. Distributing the loss from this fire over the conflagration area defined above increases slightly the premium rates of all property owners over what they would be if this hazard were not present. A heavier portion has been distributed over the forestry district of Maine than over the rest of the area because the conflagration hazard is obviously higher there. A considerable additional portion is absorbed, through the method of rating and classification suggested, by the towns in the forestry district of Maine that border upon the Province of Quebec, where an adverse hazard condition arises from social conditions on the Canadian side. The recent major conflagration is only one of a number of very large fires that have occurred along the boundary.

It is believed that the 10-year period used as a basis for the current study included the general expectation of minor conflagrations in the portion of the territory that can properly be designated as subject only to minor conflagrations; that is, there is no reason for believing that any 10-year period will show a worse burning ratio or loss experience because of larger single fires than were experienced during the 10-year period studied. No provision has accordingly been made for general allowance for conflagration hazard outside the actual experience of this period. During the period, however, a number of relatively large fires occurred which were very evidently manifestations of the hazard of minor conflagrations not properly absorbed in the towns in which they occurred but requiring distribution over towns in substantially the same situation and in which such fires may conceivably occur during other decades.

This sort of distribution was made in a considerable number of cases in Maine, New Hampshire, Vermont, Massachusetts, and New York. It was not made in Pennsylvania because of different hazards and the lack of information as to forest areas within individual towns. Here the rating and underwriting unit is necessarily the county, the county being the smallest unit area for which forest area estimates have been compiled. Since there has been no single large fire in Pennsylvania that did not appear to result largely from hazard or protection conditions peculiar to the locality in which it occurred, it appears most equitable for each county in this State to absorb its whole loss expectation.

This allowance for conflagration hazard is distinct from the general allowances for contingencies which must be made a part of any experi-

mental introduction of fire-insurance writing. As is the case with the other major elements of hazard, the conflagration hazard will lend itself to improved handling on the basis of fire-insurance experience. For the present, and through the trial period, it can be confidently hoped that the method suggested, together with the proposed safeguards against unknown contingencies, will provide a practical factor of safety, ample for the insurance carriers without being excessively burdensome for the policyholders.

#### FOREST FIRE INSURANCE FORMS RECOMMENDED FOR USE IN THE NORTHEAST

Forms for writing forest fire insurance in the Northeast will be substantially similar to those required in the West but will differ in some details. These differences are not likely, however, to necessitate special forms for individual localities or types of forest. Without attempting to foresee all the forms that general practice would probably require it is advisable to outline tentatively a few of the more essential.

A suggestion is made below for a rider form, which should apply equally well in all parts of the Northeast, to be attached to the policy forms legally prescribed in the various States for the purpose of effecting insurance on forest properties. The present wording is offered merely as a suggestion; modification may be required in use, and practical experience will indicate improvements. This also applies to the proposed application form that follows the suggested rider form.

#### FOREST PROPERTY INSURANCE—NORTHEASTERN STATES

(Front of form)

- S. .... On standing timber of saw-timber size and of the following species (and no others) .....
- S. .... On standing hardwood timber of cordwood size and of the following species (and no others) .....
- S. .... On standing timber of unmerchantable size and of the following species (and no others) .....
- S. .... On plantation of living trees of the following species (and no others) situated on (his) (her) (their) property of ..... acres, located as follows: .....
- in the county of ....., State of .....

The term "timber of saw-timber size" shall be construed to mean, in the case of softwood species, such portions of living trees of 6-inch or greater diameter at 4½ feet above the ground and in the case of hardwood species, such portions of living trees of 10-inch or greater diameter at 4½ feet above the ground as are sufficiently free from all decay and other seen or unseen defects as to possess market value, unless otherwise noted hereon.

The term "timber of cordwood size" shall be construed to mean such portions of living trees of hardwood species of 3-inch or greater diameter at 4½ feet above the ground but of less than 10-inch as are sufficiently free from all decay or other seen or unseen defects as to possess market value, unless otherwise noted hereon.

The term "timber of unmerchantable size" shall be construed to mean living trees of hardwood species of 3 feet or greater height but not exceeding 3 inches in diameter at 4½ feet above the ground and living trees of softwood species of 1 foot or greater height but not exceeding 6 inches in diameter at 4½ feet above the ground and sufficiently free from decay or other seen or unseen defects as to possess a potential market value, unless otherwise noted hereon.

The term "plantation" shall be construed to mean living trees planted artificially, as distinguished from reproduction or second growth which has come in from natural seeding without personal supervision and planting.

This policy does not cover any species or varieties of timber or growth other than that above described.

It is understood and agreed that this company shall not be liable for loss caused directly or indirectly by volcanic eruption, earthquake, or other natural convulsion.

It is further understood and agreed that this company shall be liable, in case of loss, only for the difference between the value of the standing timber or plantation trees before the fire and the salvage value of the said timber or trees immediately after the fire.

It is understood and agreed that the premium rate named in this policy includes a charge equal to eighty percent (80%) of the annual premium for the additional hazard incurred during the dry season, and it is a part of the consideration of this policy, and the basis upon which the rate is fixed, that in case of cancellation by the assured the return premium shall be calculated at the customary short rates of the difference between the dry-season charge and the full premium charged.

It is understood and agreed that the dry season hereinabove referred to shall be any part of the months of March, April, May, June, July, August, September, October, and November.

It is understood and agreed and made a condition of this policy that if cutting be commenced on or within one-half mile of any of these lands, or any portable or permanent mill be or become erected on the premises, or within one-half mile of any part thereof, or, if the hazard be increased in any other manner, without consent of this company, endorsed hereon, this policy shall cease to cover and shall be null and void.

Attached to and forming part of policy No. \_\_\_\_\_ of the \_\_\_\_\_  
Company. Agency at \_\_\_\_\_ Dated \_\_\_\_\_  
19\_\_\_\_\_

The provisions printed on the back of this form are hereby referred to and made a part hereof.

-----  
[Reverse of form]

Agent.

It is further understood and agreed that the written application for the within insurance signed by the insured and dated \_\_\_\_\_ is hereby referred to and made a part of this policy, and said insured warrants that each and all of the answers made in said application are true to his best knowledge and belief and agrees that if any of said answers be known by him to be untrue this insurance shall be null and void.

It is understood and agreed that in event of loss, this insurance shall attach to each and every acre of the property described herein, in the exact proportion that the value of each acre shall bear to the value of the whole property at the time of the fire, quality and density of stand, and logging facility considered.

In no event shall this policy be liable for more than \$\_\_\_\_\_ per acre, nor more than \$\_\_\_\_\_ per M bd. ft., nor more than \$\_\_\_\_\_ per cord.

It is understood and agreed that, in event of loss, this company shall not be required to accept proof of loss nor to make payment of indemnity, unless it so elects, prior to December 1 of the year next following the year of the date of said loss nor shall this company, in any event, be liable under this policy for payment of losses less than \$\_\_\_\_\_ in the aggregate of actual value of property insured hereunder.

The time during which suit or action on this policy, for the recovery of any claim, may be commenced is hereby extended to the end of the thirtieth month next after the date of the fire.

Loss, if any, under this policy, shall be payable to \_\_\_\_\_ mortgagee, as interest may appear.<sup>3</sup>

*Reduced rate average clause.*—In consideration of the reduced rate and premium at which, and the form under which this policy is written, with special reference to the *three-quarter loss clause*, it is stipulated and made a condition of the contract that, in the event of loss, this company shall be liable for no greater proportion of three-quarters of such loss than the amount hereby insured bears to

<sup>3</sup> It will doubtless many times be desirable to substitute a standard mortgage clause for this simple loss-payable clause. Possibly the latter should be entirely omitted, space being left for insertion in all cases of such standard mortgage clause as will meet the requirements.

seventy-five percent (75%) of the actual value described herein at the time when such loss shall happen.

*Three-quarter loss clause.*—It is understood and agreed to be a condition of this insurance that in the event of loss or damage under this policy, this company shall not be liable for an amount greater than three-fourths of such loss (not exceeding the sum insured) and, in the event of additional insurance permitted hereon, then this company shall not be liable for an amount greater than its proportion of three-fourths of such loss; in both events the other one-fourth to be borne by the insured.

-----  
Agent.

The policy-rider form suggested above contains a few items that call for special comment. The dry-season clause is inserted in order to provide for the absorption of the bulk of the annual premium during the hazardous season, with recognition at the same time of the fact that in parts of the territory damaging fires may occur during the winter months. Without this provision, owners could insure in the spring and cancel in the fall, receiving a considerable return premium in spite of the fact that they had had protection against practically all of the hazard. The shorter dry season in the north could be allowed for by striking out the words "March" and "November."

The extensions of the time limits for payment of indemnity and commencement of legal action are desirable because the damage from forest fires is usually not easy to estimate in less than 1 year after the fire. This calls for some delay all along the line of adjustment and loss settlement and is as much for the benefit of the assured as for that of the company.

The reduced rate average clause, as quoted, is only a general sample. The exact wording in any given State would of course have to comply with the legal requirements which are ordinarily quite specific in this respect.

The three-quarter loss clause is included, in combination with the previously suggested reduced rate average clause, for the purpose of limiting payment of all losses to three-quarters of the amount of the loss during the introductory period. This is believed to be a needed safeguard while the insurance is on trial, not only as protection for the carriers against moral hazard but as a measure toward keeping a somewhat more even distribution of liability than would be possible if full liability were accepted everywhere. Since the assureds are only asked to pay three-quarters of the full premium they are not victims of any injustice. The principle is that insurance to three-quarters of the loss is better than no insurance. This is unquestionably a sound principle.

The following form is suggested for use in making application for forest fire insurance in the northeastern territory. It is believed that a single form will serve. Since the information furnished by the applicant constitutes the basis for rating and underwriting the risk, it is not only desirable that it be quite complete but it must be furnished by the applicant as a warranty, with provision for avoidance of liability if there is falsification. In practice, of course, the information supplied in the applications would be supplemented to a considerable degree by inspection of the insured risks.

APPLICATION FOR INSURANCE ON FOREST PROPERTY

(This application must be complete, and signed by the insured, and attached to the company's daily report, and copy thereof attached to policy. Unless specifically permitted in writing and endorsed on the policy, application must be made on or before April 1 of the year or season for which insurance is desired.)

Application of \_\_\_\_\_, P. O. address \_\_\_\_\_,  
for insurance in the \_\_\_\_\_ Company

Against loss or damage by fire  
To the amount of \$ \_\_\_\_\_ for the term of 1 year, from the \_\_\_\_\_ day  
of \_\_\_\_\_, 19\_\_\_\_. On property particularly specified and described below,  
all only while situated as follows: \_\_\_\_\_

Item No.	Applicant's valuation	Amount to insure	Description of property to be insured
1	\$ _____	\$ _____	On approximately _____ acres of standing timber of saw-timber size (hardwoods 10 inches and larger d. b. h., softwoods 6 inches and larger d. b. h.) of the following species and no others) _____
2	\$ _____	\$ _____	On approximately _____ acres of standing hardwood timber of cord size (not less than 3 inches d. b. h. nor more than 10 inches d. b. h.) of the following species (and no others) _____
3	\$ _____	\$ _____	On approximately _____ acres of standing timber of unmerchantable size (hardwoods not less than 3 feet in height nor more than 3 inches d. b. h., softwoods not less than 1 foot in height nor more than 6 inches d. b. h.) growing under and on the same ground with the timber of saw-timber or cordwood size described in items 1 and 2, of the following species (and no others) _____
4	\$ _____	\$ _____	On approximately _____ acres of standing timber of unmerchantable size (as described in item No. 3) growing on ground other than that specified in item No. 3, and on which there is no timber of saw-timber or cordwood size, of the following species (and no others) _____
5	\$ _____	\$ _____	On approximately _____ acres of living plantation trees of the following species (and no others) _____

All questions on both sides of this application must be fully answered by applicant

1. How long has applicant owned this property? \_\_\_\_\_ Is this property mortgaged or encumbered? \_\_\_\_\_ If mortgaged, give amount of mortgage. \_\_\_\_\_ Name and address of mortgagee. \_\_\_\_\_ If otherwise encumbered or title not clear, describe circumstances. \_\_\_\_\_

Is property in litigation or dispute? \_\_\_\_\_ Describe. \_\_\_\_\_







The writing of forest fire insurance will undoubtedly require the development of special forms to fit special cases. The development of these will follow established practices and will not be unduly difficult. A few such possible forms are described in the Pacific coast bulletin (7), and the subject needs no further elaboration here.

### CONSTRUCTION OF THE RATING SCHEDULE

The rating schedule here suggested for experimental use is built, like those suggested for the Pacific coast territory, on the general form of the so-called universal mercantile schedule. This form seems to meet the special requirements of forest rating particularly well.

The inquiries and analyses made in connection with the study are believed to have produced determinations of the grand aggregate of hazard, region by region, that are accurate within allowable practical limits. When it is said, for example, that the average annual loss of forest values in the territory is 0.135 percent, very little speculation is involved. Defensible statistics show that this expresses very closely the situation as it exists.

Needless to say, no forest fire insurance project could hope to succeed on a flat rate to all property owners. It is necessary to break down this grand average to express internal variations of relative hazard and, so far as practical, according to the net hazard actually incurred by the insured property. If the net hazard is prohibitively high the risk must be declined. The expression of such variations involves a degree of speculation and rationalization. Adequate statistical data would be too costly to obtain, and it can be questioned whether they are available at all except as the result of insurance practice, and then probably only in part. It is plainly understood by the insurer and the insured that these variations exist. Obviously an area exposed to dry logging slash incurs a greater hazard than one otherwise similar but free from such exposure. Causative agencies increase the hazard of directly adjoining risks over and above that of risks further removed. Property owners whose risks are relatively free from these hazards will demand lower rates than for risks not so free. The allowances provided for in the rating schedule are those which careful study and consideration indicate as indispensable to practical and equitable rating in the territory.

During the fire season, in this territory, winds from southerly and westerly quarters ordinarily cause fire to spread more rapidly and strongly than winds from northerly or easterly quarters. This is because the northerly and easterly winds ordinarily bring in cooler or moister air, often accompanied by rain.

Because of this condition, hazards located in a general westerly or southerly direction from a risk increase the chance of loss more than similar hazards located to the north or east. Allowance for this is made in the schedule. Since, however, there are exceptions to this general condition, provision is made for increasing the rates on risks exposed to hazards lying to the north or east but with charges reduced below those for hazards lying south or west. Northwest winds are considered as westerly; southeast winds, as easterly.

By the method adopted, the ultimate standard normal (least hazardous possible) risk is a stand of pure hardwood composed mainly of trees 10 inches and over d. b. h., not exposed to slash, to brushy,

scrubby, or waste land, to previously burned or cut-over areas, or to commercial blueberry lands; containing no dead or dying timber; not exposed to a railroad or logging railroad or to logging or other cutting operations; and located in a class 1 town. Certain unusual conditions such as artificial fire lines or special patrols may reduce the hazard below the adopted standard. Because they are unusual they are allowed for as credits carrying the rate below the normal standard rather than as elements of the standard itself. There are of course a number of additional hazard factors, certain types of undergrowth, or fishing streams, for example, the absence of which reduces the hazard, but it is not believed that any of them is of sufficient practical importance to justify recognition or specific allowance. Possibly experience will disclose the existence of elements of variable hazard of such degree and general application as to call for admission to the schedule. Only time can give an accurate indication in this regard.

It is believed that the schedule proposed for introductory insurance writing in the territory will serve satisfactorily in all the four forest regions. A considerable quantity of summarized data and the main elements of calculation are presented, illustrating the sort of statistical material available and the uses to which it was put.

The construction of the rating schedule involved the use of all these data, together with such rational interpretation as could not be avoided in view of the requirements of time, economy, and practical use.

One of the chief adaptations to the requirement of practicability is the arbitrary narrowing of the range of premium rates as compared to the range of net hazard as it appears to exist in the data. This is illustrated by the town classification. According to the data, towns classify all the way from perfect (no loss during the 10-year period studied) to an average annual burning ratio, on a value basis, of 4.18 percent. By the town classification adopted, no practical premium rate could fall below 0.17 percent, the lowest town basis rate. The highest town basis rate, as provided by the schedule, is 1.75 percent.<sup>6</sup> This arbitrary narrowing of the rate is believed to be essential, since equitable distribution of the insurance service among the policyholders would be impossible if strict adherence to the scale of hazard were maintained. Minimum rate and premium provisions also work toward this end. Regardless of slight hazard, an owner's premium must be sufficient to defray the cost of issuing the policy and administering the insurance.

The rates proposed in the schedule presuppose the inclusion in the policy of the 100-percent coinsurance (average) clause; that is, they attempt to express losses exactly as they have occurred. When a lower coinsurance requirement is used, the rate scale, other things being equal, will have to be raised somewhat. Standard formulas for this have been long in use in the fire-insurance business.

The schedule as suggested is intended only for ordinary commercial fire insurance. This study has not attempted to suggest possible rates for insurance covering only mortgagee interests or excess-cover lines.

The use of the schedule in the States not included in the sample will require some preliminary work, such as the construction of maps

<sup>6</sup> Somewhat higher town basis rates may be required during the early years of experimental introduction. See footnote 9, p. 34.

indicating town or county classifications. The philosophy of such work is explained in detail in the ensuing discussion.

On the following pages are presented, region by region, the summary data and calculations utilized in determining the facts and principles underlying the design of this rating schedule. The files of the Northeastern Forest Experiment Station contain the detailed statistics and computations on which these summaries are based, which are available for such purposes as they may be made to serve. The proposed schedule is presented at the end of this bulletin.

#### NORTHERN FOREST REGION

During the 10-year period studied (1925-34),<sup>7</sup> according to summaries compiled by the State foresters of Maine, New Hampshire, Vermont, Massachusetts, and New York, the area of northern forest burned by all reported fires (exclusive of grass areas burned) was 265,700 acres. The indicated average annual burned area is accordingly 26,570 acres.

The field work was done on 24 burns, reported as covering 109,530 acres. The field analysis discloses, however, that the burns had actually covered only 77,882 acres, 28.9 percent less. This figure of 28.9 percent was taken as representing the extent to which burned areas have been overestimated in the region<sup>8</sup> and was applied to the total of 26,570 acres, reducing it to 18,891 acres. This was taken as the average area burned annually in the region during the period studied.

According to figures arrived at by the field analysis, this total burned area is made up as follows:

	Acres
Merchantable growth <sup>1</sup> .....	15,681
Young growth <sup>1</sup> .....	2,076
Brush.....	1,134
<b>Total.....</b>	<b>18,891</b>

<sup>1</sup> Practically all of the area bearing merchantable growth also bears young growth. Young growth areas carry occasional trees of merchantable size.

The burning of these areas was accompanied by loss and damage to the trees growing on them. Determining loss and damage figures on a 77,882-acre sample was the work of the field analysis. In this work it was found that classifications of merchantable growth, young growth, and brush could be made only in a general way, depending on the predominant feature. Many areas classified as brush bear also considerable amounts of young growth and, occasionally, trees of merchantable size. Likewise, young growth areas may carry a measurable volume of merchantable growth. This condition made necessary the adoption of an average expression of the probable damage to merchantable growth when an acre of forest land in the forest region is burned; that is, all computations of loss of merchantable growth are based on the gross burned area regardless of the three classifications listed above. In this calculation allowance is made for killing by the fire, for partial damage to trees that were not killed, and for salvage probabilities. In allowing for salvage the degrade or loss in value due to the fire was taken into consideration. The

<sup>7</sup> In New York the period studied was 1926 to 1935, inclusive. In Maine it was 1926 to 1934. Proper allowance is made.

<sup>8</sup> Throughout this work, both in the East and the West, it has been found that the recorded figures are consistently in excess of the areas actually burned.

assumption of course is that what happened on 77,882 acres can be taken as an indication of what happens in the aggregate over the whole region over a period of years. Table 4 shows a summarization of the net loss probability of merchantable growth per acre burned.

TABLE 4.—*Damage, salvage, and net loss expectation of merchantable growth in the northern forest region as determined from field analysis, per acre burned*

Species and commercial class	Killed	Lost by partial damage	Gross loss	Salvaged	Net loss
	<i>Mft. b. m.</i>	<i>Mft. b. m.</i>	<i>Mft. b. m.</i>	<i>Mft. b. m.</i>	<i>Mft. b. m.</i>
Spruce.....	0.594	0.007	0.601	0.021	0.580
Fir.....	.091	.003	.094	.001	.093
Hemlock.....	.047	.001	.048	.002	.046
White pine.....	.472	.030	.502	.038	.464
Cedar.....	.309	.007	.316	.007	.309
Other softwoods.....	.072	.003	.075	.003	.072
Softwood saw timber.....	1.675	.051	1.726	.072	1.654
Hardwood saw timber.....	.464	.058	.522	.001	.511
Hardwood cordwood.....	<i>Cords</i> 0.655	<i>Cords</i> 0.095	<i>Cords</i> 0.750	<i>Cords</i> 0.001	<i>Cords</i> 0.749

Of the merchantable growth killed or damaged by fire on the areas covered by the field analysis, a certain portion had been or was being salvaged. What happened on these areas was taken as a fair indication of what could be expected in general. The estimates of salvage are based on this assumption.

The partial-damage estimates are arrived at by combining figures obtained by the field analysis, showing volumes in trees left alive after the fire, with estimates of partial damage to fire-scorched trees furnished by the Northeastern Forest Experiment Station from studies not published. They are believed to overestimate rather than underestimate the damage done.

The field analysis indicates very clearly that in the northern forest the effect of fire on timber of less than merchantable size is almost invariably calamitous. Very little of this small growth survives. This condition is illustrated in table 5.

TABLE 5.—*Percent of stocking with young growth before fires, average heights, and percent killed; from field analysis, northern forest region*

Species class	Stocking before fire	Average height	Killed by the fires
	<i>Percent</i>	<i>Feet</i>	<i>Percent</i>
Softwoods.....	74.2	9	95.2
Hardwoods.....	12.5	13	92.8
Combined.....	86.7	10	94.9

There is practically no exception to this heavy destruction—for all practical purposes a total loss—of small growth, softwood or hardwood, regardless of locality or conditions under which it is burned, and regardless of the degree to which timber of merchantable size is damaged.

Since, as already stated, the average expectation in the northern forest region is an annual burn of 18,891 acres, the aggregate loss

expectation in terms of volume of merchantable growth may be computed by multiplying this figure by the net loss in table 4. Table 6 shows the result of this multiplication together with the integration of this loss with the volumes at risk and burning ratios.

TABLE 6.—Quantities at risk,<sup>1</sup> average annual losses, and burning ratios, as computed, northern forest region

Species and class	At risk	Lost annually, net	Burning ratio	Species and class	At risk	Lost annually, net	Burning ratio
	<i>M ft. b. m.</i>	<i>M ft. b. m.</i>	<i>Pct.</i>		<i>M ft. b. m.</i>	<i>M ft. b. m.</i>	<i>Pct.</i>
Spruce and fir.....	27,394,500	12,713	0.046	Hardwood saw timber.....	27,980,000	9,653	0.034
Hemlock.....	4,327,000	869	.021				
White pine.....	3,498,500	8,766	.253	Hardwood cordwood.....	<i>Cords</i>	<i>Cords</i>	
Cedar.....	2,872,170	7,538	.262		90,960,000	14,140	.016
Other softwoods.....	242,000	1,360	.562				
					<i>Acres</i>	<i>Acres</i>	
Softwood saw timber.....	38,204,170	31,246	.082	Unmerchantable growth.....	21,256,000	17,757	.084

<sup>1</sup> From figures compiled by the Forest Service in 1931.

<sup>2</sup> This figure should not be compared to any of those shown in table 2, which come from other sources and are used for illustrative purposes only.

According to the State records, as adjusted by the figures obtained from the field analysis, the probability is that a total of 17,757 acres of small unmerchantable growth, 15,681 acres of it on saw-timber land, will be burned over annually. As stated above, the loss on this will be, to all practical purposes, total.

The fact that there is some young growth on the brush areas is ignored for purposes of computation, partly because it is believed that it has no insurable value in this situation, and partly because no total exposure estimate is available for it as in the case of the merchantable growth so located. This is due to the fact that merchantable growth is estimated by volume and the total-exposure figure can be applied regardless of area classification.

In order to reduce the expression for aggregate burning ratio to monetary terms, estimates were made of the average unit values, in the region, of the four classes adopted. Table 7 shows how this was done and the result.

TABLE 7.—Computation of pure premium (required to cover losses only) and distribution, by classes; monetary value basis, northern forest region

Class and unit value <sup>1</sup>	Value at risk	Lost per year	Rate per \$100
	<i>Dollars</i>	<i>Dollars</i>	<i>Cents</i>
Merchantable softwoods (\$3.75 per M ft. b. m.).....	143,265,000	117,172	8.18
Hardwood saw timber (\$2 per M ft. b. m.).....	55,960,000	19,306	3.45
Hardwood cordwood (80.25 per cord).....	22,740,000	3,537	1.56
Young growth (\$0.50 per acre).....	10,628,000	8,879	8.35
Total.....	232,594,000	148,894	6.40

<sup>1</sup> The unit values are estimates of averages for the region as a whole. Values in specific localities will be found to vary to considerable extents from these figures, in both directions.

These figures approach closely to final practicability for a rate structure, particularly the last figure, indicating an aggregate loss cost per \$100 of exposed value of 6.40 cents per year or 0.064 percent.

The statistical basis for this figure is undoubtedly ample and it can be taken as adequately authoritative. Such error as it expresses is on the side of safety and conservatism. There is probably a higher proportion of value at risk to value burned than this figure expresses. In the parts of the country where the forest survey has progressed sufficiently to obtain checks on the 1931 compilation of the Forest Service, it has indicated that somewhat greater aggregate volumes and values are present. There is no reason to suppose that the result will differ in the Northeast.

The loss-cost figures for the individual classes cannot be taken with quite the same degree of assurance. They contradict to a slight extent the obvious probabilities and can evidently be most satisfactorily used if they are subjected to some interpretation and rationalization. This is because the statistical bases upon which they rest are somewhat lacking in desirable breadth. For example, the loss cost of merchantable softwood appears to be higher than it should, both relative to merchantable hardwood and young growth. The figure for hardwood saw timber appears to be approximately in line but a more ample supply of data would unquestionably show a higher figure for hardwood cordwood. In the construction of the schedule these considerations are given weight.

It is obvious that there are significant variations of hazard within the general classes listed in table 7. Hazards are bound to vary, regardless of class, with variations in the effectiveness of protection and in physical conditions in and surrounding the specific risks being rated or underwritten.

Variation in protection is allowed for in the schedule by use of the town classifications already mentioned and illustrated in figure 5. The computation indicated that the average annual burned areas of individual towns vary all the way between none and upward of 16 percent. It is true that the effectiveness of protection is not the only rating indicated by this classification. The other general causative and contributive hazard conditions mentioned previously are included when and as they operate; but this is fortunate rather than otherwise for the inquiry. Application of the town classification system simplifies the method and eliminates the need of identifying and measuring some of these hazard factors.

The basis for the classification of the towns is their past forest-fire experience, expressed as a percentage burning ratio by area, modified by consideration of the number of consequential fires recorded. This consideration is essential to proper classification as is explained on page 16. If the forest-land area of a town is known with approximate accuracy, and a record exists of the areas burned during a period of years, a usable figure can be computed expressing the town's forest-fire experience in terms of the ratio of average annual burned areas to the total forest area of the town. As a step in the process of this inquiry such burning ratios were computed for all the towns of Maine, New Hampshire, Vermont, Massachusetts, and New York. The impossibility of doing the same thing in Pennsylvania has already been explained.

For fire-insurance practice a more finished system of classification is required, in monetary terms and, as has been explained, incorporating a number of adjustments for conditions not indicated by the bare data. The calculations yield expressions, adequately sup-

ported by statistics, of the normal burning ratios by area of the individual States and towns within the States. It is possible, as has been shown, to convert the figure for burning ratio by area to one expressing the burning ratio by value which shows some departure because of different weights. Expressions of burning ratios by value for the individual towns have been developed by straight proportion; area burning ratio of the State is to area burning ratio of the town as value burning ratio of the State is to value burning ratio of the town. In doing this the States are broken into their respective divisions by forest regions and each worked separately.

In the last phase of this finishing process the three lowest classes were grouped into one, reducing the total number from 12 to 10. This was desirable because, on a value basis, there was too little difference between them to justify practical distinction and, also, minimum rate and premium considerations robbed the lowest classifications of their significance. This last consideration also dictated the adoption of the town basis rates recommended in the rating schedule which are, of course, drawn from this town classification but modified in compliance with the practical requirements of the service feature.

As has been stated, this application is made subject to a degree of rationalization and interpretation which eliminates inequities and improper expressions that would result from a strict adherence to the figures.

The development of a schedule inevitably involves allowance for the cost of conducting the business. Accuracy in estimating the probable cost of carrying on forest fire insurance is difficult. For the present it can only be assumed that the cost of doing business, plus a fair profit to the carriers, will approximately equal the aggregate loss costs, as is the case in much of the established fire-insurance business. In addition, some allowance must be made for indeterminate contingencies remaining even after a study of this kind has done all it can. There are several unknown factors, determinable only through practice. No properly conducted insurance organization would attempt to do a trial business without providing for a reserve to cover these unknowns. In the schedule suggested, such provision is made. As proposed, the schedule provides through loadings for general contingencies and major conflagration hazard, for an average premium rate of four times the indicated aggregate loss cost, giving a factor of safety of 100 percent over loss cost and expenses.<sup>9</sup> Owing to the fact that in the absence of forest-survey figures no authoritative indications can be had of the relative weightings of values subject to variations in relative hazards, no mathematical tests of the rates proposed are possible. It is believed, however, that careful study of the data and text here presented and of the proposed schedule, with particular reference to the report on the work in the West (7), will convince the reader that the schedule actually does offer a prac-

<sup>9</sup> The length of the trial period during which the use of this safety factor is advised is indefinite, depending on the rate of growth of the business, the losses incurred, and the extent to which the business is able to establish itself firmly and soundly. Without doubt it would be essential that a somewhat higher safety factor be applied during the earlier years of the trial period, not only because all uncertainties will then be at the maximum, but because such provision would automatically allow for the additional expenses incident to organization. This means that for the few years immediately following introduction the rate scale would be somewhat higher than is proposed in this bulletin. Successful experience during those very early years should result in a reduction at least to the level of the suggested schedule and possibly enough lower to bring the total premium collection for the period to what it would have been had this schedule been used throughout.

tical basis for forest fire insurance in the region during a trial period. As more experience is gained the business should be so conducted as to make improvement based on such experience as great and as rapid as possible.

#### NORTHEASTERN WHITE PINE REGION

During the 10-year period studied,<sup>10</sup> according to summaries compiled by foresters of the five sample States, the area of white pine land in the Northeast burned by all reported forest fires (exclusive of grass areas) was 347,490 acres, or 34,749 acres per year.

Field work in the northeastern white pine region covered 44 burns and disclosed that the 10,167 acres reported as affected by these burns was actually only 6,247 acres, or 38.6 percent less than reported. This figure of 38.6 percent was accordingly applied to the entire reported area of 34,749 acres, reducing it to 21,336 acres. This was taken as the average area annually burned in the region during the period studied.

According to figures arrived at by the field analysis, this total burned area is made up as follows:

	Acres
Merchantable growth <sup>1</sup> .....	7,634
Young growth <sup>1</sup> .....	8,265
Brush.....	5,437
Total.....	21,336

<sup>1</sup> Practically all of the area bearing merchantable growth also bears young growth. Young growth areas carry occasional trees of merchantable size.

The loss and damage to the growth on these areas was determined by field analysis of the results on a 6,247-acre sample. From these findings, together with findings of other fire-damage research, the probable damage on any given acre of northeastern white pine forest was estimated. The same calculations for killing, partial damage, salvage, and degrade were made as in the case of the northern forest region (p. 30). Table 8 shows a summarization of the net loss probability of merchantable growth per acre burned.

TABLE 8.—Damage, salvage, and net loss expectation to merchantable growth in the northeastern white pine region as determined from field analysis, per acre burned

Species and commercial class	Killed	Lost by partial damage	Gross loss	Salvaged	Net loss
	<i>M ft. b. m.</i>	<i>M ft. b. m.</i>	<i>M ft. b. m.</i>	<i>M ft. b. m.</i>	<i>M ft. b. m.</i>
White pine.....	0.637	0.063	0.700	0.225	0.475
Pitch pine.....	.067	None	.067	.002	.065
Hemlock.....	.020	.002	.022	None	.022
Other softwoods.....	.016	.001	.017	.001	.016
Softwood saw timber.....	.740	.066	.806	.228	.578
Hardwood saw timber.....	.021	.070	.091	.001	.090
	<i>Cords</i>	<i>Cords</i>	<i>Cords</i>	<i>Cords</i>	<i>Cords</i>
Hardwood cordwood.....	1.012	0.234	1.246	0.028	1.218

According to the field data gathered, the effect of fire on young unmerchantable growth is only slightly less calamitous than in the northern forest region, as shown in table 9. The slightly better showing in the white pine region is really of no practical significance,

<sup>10</sup> See footnote 7, p. 30.



for the 88.4 percent of reproduction on an area killed might as well be 100 percent. For all practical purposes the area is set back to scratch in the process of regeneration.

TABLE 9.—Percent of stocking with young growth before fires, average heights, and percent killed; from field analysis, northeastern white pine region

Species class	Stocking before fire	Average height	Killed by the fires
	Percent	Feet	Percent
Softwoods.....	25.2	9	87.3
Hardwoods.....	51.1	12	89.0
Combined.....	76.3	11	88.4

Since the average expectation in this region is an annual burn of 21,336 acres, the aggregate loss expectation in terms of volumes of merchantable growth is computed by multiplying this figure by the figure for net loss in table 8, with the results presented in table 10.

TABLE 10.—Quantities at risk, average annual losses, and burning ratios, as computed, northeastern white pine region

Species and class	At risk	Lost annually, net		Burning ratio	Species and class	At risk	Lost annually, net		Burning ratio
		Mft. b. m.	Pct.				Mft. b. m.	Pct.	
White and pitch pine	12,368,000	11,521	0.093	Hardwood saw timber	2,664,000	1,921	0.072		
Hemlock	2,435,000	470	.019						
Other softwoods	1,155,000	341	.029						
Softwood saw timber	15,998,000	12,332	.077	Hardwood cordwood	22,842,000	25,988	.114		
				Unmerchantable growth	18,631,000	15,899	.184		

† This figure should not be compared to any of those shown in table 2, which come from another source and are used for illustrative purposes only.

According to the State records, as adjusted by the field analysis figures, the probability is that a total of 15,899 acres of small, unmerchantable growth (7,634 acres also bearing merchantable timber) will be burned over annually, on which the loss will be practically total.

These annual loss expectations of merchantable and young growth involve, according to figures compiled by the Forest Service in 1931, total exposures as given in column 2 of table 10, which presents also the annual loss expectations and the resultant burning ratios.

By the simple process of combining the species into general classes and applying unit value figures to indicate burning ratios in terms of monetary values, the results shown in table 11 are gained.

TABLE 11.—Computation of pure premium (required to cover losses only) and distribution by classes; monetary value basis, northeastern white pine region

Class and unit value †	Value at risk †	Lost per year	Rate per \$100
Merchantable softwoods (\$4.75 per M ft. b. m.)	Dollars 75,990,500	Dollars 58,577	Cents 7.71
Hardwood saw timber (\$5 per M ft. b. m.)	13,320,000	9,605	7.21
Hardwood cordwood (\$1 per cord)	22,842,000	25,988	11.39
Young growth (\$0.50 per acre)	4,315,500	7,950	18.42
Total	116,468,000	102,120	8.77

† The unit values are estimates of averages for the whole region as explained in table 7.

As in the northern forest region, the final loss cost (in this case 8.77 cents per \$100 per year) can be taken as sufficiently authoritative and probably slightly conservative. Here, too, the individual class figures require some interpretation and rationalization. They are more in line with rational expectations than in the previous region, but more ample data would probably show a somewhat higher relative loss in young growth and possibly a lower loss in hardwood saw timber.

There is no question but that these data meet the needs of introductory forest fire insurance in the northeastern white pine region and they have accordingly been employed in developing the proposed schedule of rates.

## NORTHEASTERN OAK REGION

Summaries by the State foresters of New York and Pennsylvania record 1,186,680 acres burned in the northeastern oak region by all reported fires (exclusive of grass areas) during the 10-year period studied, or 118,668 acres per year.

The field work on 71 burns showed that the 21,528 acres reported burned on these areas actually amounted to only 18,369 acres, or 14.7 percent less than reported. This figure of 14.7 percent applied to the reported annual average of 118,668 acres reduces it to 101,224 acres. This figure thus represents the average area actually burned annually in the region during the period studied.

According to figures arrived at by the field analysis, this total burned area is made up as follows:

	Acres
Merchantable growth <sup>1</sup> .....	28, 599
Young growth <sup>1</sup> .....	59, 600
Brush .....	13, 025
<b>Total</b> .....	<b>101, 224</b>

<sup>1</sup> Practically all of the area bearing merchantable growth also bears young growth. Young growth areas carry occasional trees of merchantable size.

The probable damage per acre burned was calculated in the same manner as already described for the northern forest and the northeastern white pine regions. Table 12 summarizes the loss and damage probability of merchantable growth per acre burned.

TABLE 12.—*Damage, salvage, and net loss expectation of merchantable growth in the northeastern oak region as determined from field analysis, per acre burned*

Species and commercial class	Killed	Lost by partial damage	Gross loss	Salvaged	Net loss
	<i>M ft. b. m.</i>	<i>M ft. b. m.</i>	<i>M ft. b. m.</i>	<i>M ft. b. m.</i>	<i>M ft. b. m.</i>
Pitch pine <sup>1</sup> .....	0.012	None	0.012	(?)	0.012
White pine .....	.004	0.008	.012	(?)	.012
Hemlock .....	.001	.001	.002	(?)	.002
Softwood saw timber .....	.017	.009	.026	(?)	.026
Hardwood saw timber .....	.054	.127	.181	(?)	.181
Hardwood cordwood .....	<i>Cords</i> 0.639	<i>Cords</i> 0.782	<i>Cords</i> 1.421	<i>Cords</i> 0.604	<i>Cords</i> 1.417

<sup>1</sup> And other southern pines

<sup>2</sup> There was some salvage of saw-timber material, too small for expression in 3 places to the right of the decimal.

As in the two regions previously discussed, fire damage to young unmerchantable growth in the northeastern oak region is severe, as shown in table 13. The figure for percent damage is close to the corresponding figure for the northeastern white pine region and constitutes, as it does there, substantially total loss. When the northeastern oak forest burns, the probability is that the young growth will be set back to scratch.

TABLE 13.—*Percent of stocking with young growth before fires, average heights, and percent killed; from field analysis, northeastern oak region*

Species class	Stocking before fire	Average height	Killed by the fires
	Percent	Feet	Percent
Softwoods.....	2.4	8	73.4
Hardwoods.....	73.0	10	87.6
Combined.....	75.4	10	87.1

Since the average expectation in the northeastern oak region is an annual burn of 101,224 acres the aggregate loss expectation is computed by multiplying this figure by the figures for net loss in table 12, with the result shown in table 14.

TABLE 14.—*Quantities at risk, average annual losses, and burning ratios, as computed, northeastern oak region*

Species and class	At risk	Lost annually, net	Burning ratio	Species and class	At risk	Lost annually, net	Burning ratio
Pines.....	<i>Mft. b. m.</i> 3,667,000	<i>Mft. b. m.</i> 2,430	<i>Pct.</i> 0.066	Hardwood saw timber.....	<i>Mft. b. m.</i> 6,223,000	<i>Mft. b. m.</i> 18,321	<i>Pct.</i> 0.294
Hemlock.....	1,356,000	202	.015				
Other softwoods.....	26,000	0	0	Hardwood cordwood.....	<i>Cords</i> 51,478,000	<i>Cords</i> 143,434	.279
Softwood saw timber.....	5,049,000	2,632	.052	Unmerchantable growth.....	<i>Acres</i> 10,008,000	<i>Acres</i> 88,199	.881

According to the State records, adjusted by the figures from the field analysis, the probability is that a total of 88,199 acres of small, unmerchantable growth (occurring with merchantable growth on 28,599 acres) will be burned over annually and will represent a total loss.

These annual loss expectations on merchantable and young growth involve, according to the figures compiled by the Forest Service in 1931, total exposures as shown in column 2 of table 14. When the annual loss expectations are divided by these figures, average annual burning ratios are obtained, as shown in the last column of the table.

Table 15 shows the result of combining the species into general classes and applying unit-value figures to indicate burning ratios in terms of monetary values.

TABLE 15.—*Computation of pure premium (required to cover losses only) and distribution by classes; monetary value basis, northeastern oak region*

Class and unit value <sup>1</sup>	Value at risk <sup>1</sup>	Lost per year	Rate per \$100
	<i>Dollars</i>	<i>Dollars</i>	<i>Cents</i>
Merchantable softwoods (\$3.75 per M ft. b. m.).....	18,938,750	9,870	5.21
Hardwood saw timber (\$5.50 per M ft. b. m.).....	34,254,000	100,760	29.42
Hardwood cordwood (\$1.50 per cord).....	77,217,000	215,151	27.86
Young growth (\$0.50 per acre).....	5,004,000	44,100	88.13
Total.....	135,408,750	369,887	27.32

<sup>1</sup> The unit values used are estimates of averages for the whole region, as explained in table 7.

This aggregate loss cost of 27.32 cents per \$100 per year is distinctly higher than the corresponding figures for the northern forest and northeastern white pine regions. The implication is that not only will more careful underwriting be called for in the northeastern oak region but that on relatively large local areas forest fire insurance will be impractical.

The loss-cost figure is, as in the other regions and for the same reasons, probably somewhat conservatively high. It is recommended, however, that a factor of safety over and above the indications be introduced into the final calculations. The township and county classifications developed by the inquiry and discussed in detail elsewhere in this bulletin will indicate the localities in which more difficult or prohibitive underwriting conditions prevail.

#### ALLEGHENY HARDWOOD REGION

The 185,690 acres (exclusive of grass areas) reported burned in this region from 1926 to 1935 was found, as in the other regions, to be excessive. Field analysis of seven burns reported as representing 1,271 acres developed an actual burned area of 884 acres only, or 30.4 percent less. Although the basis for this figure is somewhat slender, it is believed that such a reduction is a reasonable one since the result is in line with results in other regions more heavily sampled. When the reported average annual burn of 18,569 acres is reduced by 30.4 percent, it becomes 12,924 acres, which was taken as the correct figure for the region.

According to figures arrived at by the field analysis, this total burned area is made up as follows:

	<i>Acres</i>
Merchantable growth <sup>1</sup> .....	5,835
Young growth <sup>1</sup> .....	6,826
Brush.....	263
Total.....	12,924

<sup>1</sup> Practically all of the area bearing merchantable growth also bears young growth. Young growth areas carry occasional trees of merchantable size.

Loss and damage probability of merchantable growth per acre burned, as determined from field analysis of the 884-acre sample, is given in table 16.

TABLE 16.—*Damage, salvage, and net loss expectation of merchantable growth in the Allegheny hardwood region as determined from field analysis, per acre burned*

Species and commercial class	Killed	Lost by partial damage	Gross loss	Salvaged	Net loss
	<i>Mft. b. m.</i>	<i>Mft. b. m.</i>	<i>Mft. b. m.</i>	<i>Mft. b. m.</i>	<i>Mft. b. m.</i>
Pitch pine.....	0.014	0	0.014	0	0.014
White pine.....	.011	.020	.031	0	.031
Hemlock.....	.003	.003	.006	0	.006
Softwood saw timber.....	.028	.023	.051	0	.051
Hardwood saw timber.....	.028	.125	.153	.002	.151
Hardwood cordwood.....	<i>Cords</i> 2.717	<i>Cords</i> 4.225	<i>Cords</i> 6.942	<i>Cords</i> 0.027	<i>Cords</i> 6.915

Fire damage to young unmerchantable growth in the Allegheny hardwood region was somewhat less severe than in the other regions, as shown in table 17. There is some question whether the killing of three-quarters of a stand of reproduction is as serious as killing all of it. Recognizing, however, the fact that the sample taken in this region was relatively small and also the fact that much of the unkilld growth is more or less damaged, the assumption is made here, in the interest of conservatism, that the small unmerchantable growth becomes a total loss when burned over.

TABLE 17.—*Percent of stocking with young growth before fires, average heights, and percent killed; from field analysis, Allegheny hardwood region*

Species class	Stocking before fire	Average height	Killed by the fires
	<i>Percent</i>	<i>Feet</i>	<i>Percent</i>
Softwoods.....	3.1	7	69.3
Hardwoods.....	82.3	14	75.9
Combined.....	85.4	14	75.6

Since the average expectation in the Allegheny hardwood region is an annual burned area of 12,924 acres, the aggregate loss expectation of merchantable growth may be computed by multiplying this figure by the figures for net loss in table 16, as shown in table 18.

TABLE 18.—*Quantities at risk, average annual losses, and burning ratios, as computed, Allegheny hardwood region*

Species and class	At risk	Lost annually, net	Burning ratio	Species and class	At risk	Lost annually, net	Burning ratio
	<i>Mft. b. m.</i>	<i>Mft. b. m.</i>	<i>Pct.</i>		<i>Cords</i>	<i>Cords</i>	<i>Pct.</i>
Pines.....	471,000	581	0.123	Hardwood saw timber.....	2,997,000	1,951	.065
Hemlock.....	1,751,000	78	.004	Hardwood cordwood.....	41,164,000	80,369	0.217
Softwood saw timber.....	2,222,000	659	.030	Unmerchantable growth.....	5,506,000	12,661	.230

According to the State records, as adjusted by the figures obtained from the field analysis work, the probability is that a total of 12,661 acres of small, unmerchantable growth (5,835 acres of it combined

with merchantable growth) will be burned over annually, and will represent a total loss.

These annual loss expectations on merchantable and young growth involve, according to figures compiled by the Forest Service in 1931, total exposures as given in table 18, column 2. Here also are given the average annual burning ratios figured on the basis of annual loss expectations given in table 17.

Table 19 shows the result of combining the species into general classes and applying unit-value figures to indicate burning ratios in terms of monetary values.

TABLE 19.—*Computation of pure premium (required to cover losses only) and distribution by classes; monetary value basis, Allegheny hardwood region*

Class and unit value †	Value at risk †	Lost per year	Rate per \$100
	<i>Dollars</i>	<i>Dollars</i>	<i>Cents</i>
Merchantable softwoods (\$3.25 per M ft. b. m.).....	7, 221, 500	2, 142	2.97
Hardwood saw timber (\$5.50 per M ft. b. m.).....	16, 483, 500	10, 731	6.51
Hardwood cordwood (\$1.50 per cord).....	61, 745, 000	134, 054	21.71
Young growth (\$0.50 per acre).....	2, 753, 000	6, 331	23.00
Total.....	88, 204, 000	153, 258	17.38

† Unit values are estimates of averages for the whole region, as explained in table 7.

An average annual loss cost of 17.38 cents per \$100 of exposed value seems to contradict the earlier description of this region as least hazardous of all. Inherently it is the least hazardous, and, where human hazards are not too great and protection is adequate, the loss cost is very low. In New York the average annual loss cost has been only 2.27 cents per \$100. In the Pennsylvania portion, however, where hazards are higher and protection relatively less effective, the loss cost has been 23.73 cents.

Whereas in the New York portion of the region underwriting will be a simple process, in Pennsylvania considerable care will be required. Nevertheless it will be found that a large aggregate of Pennsylvania property will be acceptable at reasonable rates and terms.

#### GENERAL CONCLUSIONS AND RECOMMENDATIONS

As already stated, the schedule of premium rates proposed in this bulletin is intended primarily for use during the introductory and experimental stage of insurance application, and will probably be subject subsequently to considerable modification, both in form and general rate level, on the basis of experience.

This schedule is based on a statistically ascertained normal loss expectation for the territory as a whole of 0.135 percent per year (13.5 cents per \$100 of value), distributed as follows: Northern forest, 0.064 percent; northeastern white pine, 0.088 percent; northeastern oak, 0.273 percent; and Allegheny hardwoods, 0.174 percent.

The rate schedule is intended not only to provide for the payment of losses, cost of providing the service, and a fair profit on the business, but also, by means of arbitrary loadings in the rate, greater in some sections than in others, to include a safety factor against the inevitable indeterminate elements of early trial. Chief among these possible in-

determinate elements are incomplete reporting of losses, errors in computations, uncertainty as to the effect of adverse selection, and an insufficient allowance for conflagration hazard. The basis rates suggested for the various classes of towns have been set so as to introduce this safety factor.

Throughout most of the territory this safety factor amounts to a full doubling of the average rate. In the white pine region, that is, the average rate that the schedule is designed to produce is 35 cents per \$100 per year, or four times the normal loss expectation of 0.088 percent. On the other hand, in the forestry district of Maine and the fire towns of New York, where the State protective systems are highly organized, reporting is highly reliable, and other unknown factors are less significant than in more decentralized sections, the safety factor is only 50 percent. This decreased safety factor is largely compensated, however, by provision for the major conflagration hazard reserve which is arbitrarily distributed and brings these sections to substantially the same level as adjoining areas.<sup>11</sup>

These general allowances are incorporated in local basis rates applied to individual towns (counties in Pennsylvania) in accordance with a town-classification system that has been developed by the study. The basis rate of a town takes care of all general hazard features applying equally to the individual properties within the town. Other elements of the schedule provide for differentiation within the town. A risk on which there is fresh slash, for example, must take a higher rate than one on which there is none, both risks being in the same town and otherwise alike.

As the proposed schedule indicates, property rating in the Northeast will be simple, except as experience may reveal variables not recognized here. With insurance carriers and the property owners cooperating in a sincere effort to put forest fire insurance into effect in the territory, a successful outcome should be possible on the basis of the recommendations made here. Obviously, every attempt should be made by the carriers to lower rates and liberalize terms of underwriting as soon as conditions justify such action.

The basis rates for individual towns vary between 17 cents and \$1.73 per \$100 per year.<sup>12</sup> By far the greater number of towns will fall within the lowest classifications. The high classifications are nevertheless essential to cover conditions that actually exist in the territory. In addition to the basis rates, the schedule gives charges for variable hazard factors such as the size and character of the growth being insured, exposure to slash or other more highly hazardous areas, steam railroads, and active logging operations, all of which embody modifications in net hazard according to whether or not they apply to the specific property or risk being rated.

It is probable that the northeastern territory could by itself support a reasonably satisfactory insurance project. In order, however, that full advantage may be taken of fundamental underwriting principles, including relative freedom from restrictions as to maximum allowances subject to loss from single fires, it will be highly desirable that underwriting in this territory be integrated with forest fire insurance in the Pacific coast territory. These territories combined unquestionably form a sound basis upon which a Nation-wide business can grow.

<sup>11</sup> See footnote 9, p. 34.

<sup>12</sup> See footnotes 6, p. 29, and 9, p. 34.

Introductory attempts will best be based upon as even a balance of liability as possible between the two regions, with such gradual expansion into other regions as conditions may justify.

Such technical underwriting and administrative problems as are encountered will be no greater than those that have been met and adequately handled in the general course of business and commercial development. Forest fire insurance can render a valuable service in the national conservation program. What it chiefly needs is an impartial and unprejudiced opportunity to demonstrate its potentialities.

### RATE SCHEDULE

*Northeastern territory.*—New England, New York, New Jersey, Pennsylvania, Delaware, and Maryland.

1. *Town or county basis rates.*—Class 1, 17 cents; class 2, 21 cents; class 3, 26 cents; class 4, 33 cents; class 5, 43 cents; class 6, 57 cents; class 7, 76 cents; class 8, \$1.01; class 9, \$1.33; class 10, \$1.73.

2. *Class charges.*—Percents of basis rates:

Class 1. Hardwood 10 inches d. b. h. and over;<sup>13</sup> standard; no charge.

Class 2. Hardwood 3 inches to 9 inches d. b. h., inclusive;<sup>13</sup> 25 percent charge.

Class 3. Hardwood under 3 inches d. b. h.;<sup>13</sup> 50 percent charge.

Class 4. Softwood 6 inches d. b. h. and over;<sup>13</sup> 50 percent charge.

Class 5. Softwood under 6 inches d. b. h.;<sup>13</sup> 75 percent charge.

Class rate: \_\_\_\_\_ cents.

### CONTRIBUTIVE HAZARDS

Charges for contributive hazards are percents of class rates.

3. *Logging slash.*—Debris from logging or other wood-cutting operation. Standard is 40 acres or more on the property or directly adjacent. Standard is based on what will be on the ground at the end of the fire season, not what is there at the beginning. These charges are for slash only, whether or not operating is going on. The underwriter may omit the slash charge if, in his judgment, decay has sufficiently abated the hazard. This will ordinarily not be the case within 10 years of the time the slash is made, for softwood slash, and 5 years for hardwood slash.

*Slash exposure charges,<sup>1</sup> percents of class rate*

	Direct exposure		$\frac{1}{4}$ to $\frac{1}{2}$ mile <sup>1</sup>		$\frac{1}{2}$ to 1 mile	
	South and west	North and east	South and west	North and east	South and west	North and east
Area occupied by slash (acres):	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	
40 or more.....	150	75	120	60	60	None.
30 to 40.....	125	65	100	50	50	Do.
20 to 30.....	100	50	80	40	40	Do.
10 to 20.....	75	40	60	30	30	Do.
Less than 10.....	50	25	40	20	20	Do.

<sup>1</sup> Same in all classes. The underwriter is to decide whether or not the slash charge shall apply. Where partial slash disposal is judged to be sufficiently effective, or where slash has resulted only from slight partial cutting, the charge may be omitted. It must always either be charged in full or wholly omitted. No charge in any event for slash more than 1 mile away.

<sup>2</sup> Direct exposure through communicating forest areas. No charge if cultivated fields, water, or other barriers intervene ( $\frac{1}{4}$  mile or more in width). No charge in any event if more than 1 mile away.

4. *Previously burned lands, brush, scrub, or "plains" areas.*—Areas in a substantially deforested condition; that is, mainly occupied by brush, grass, scrub oak, pitch pine, gray birch, sweetfern, poplar, pin cherry, or other scrubby or non-commercial species. Includes all areas qualifying substantially as "waste land," but not areas merely cut clean and restocking with commercial species either by seed or sprout. This charge must be applied for all exposures to areas burned

<sup>13</sup>Stand composed mainly of trees of specified sizes.



within the past 10 years. It may be omitted after 10 years if the burned area has become sufficiently well stocked with commercial species. None of the species named above are to be considered as commercial species if they occupy the major portion of the ground and this charge must apply in all cases where this condition exists regardless of the cause.

*Burned land, brush, scrub, or "plains" charges, percents of class rate<sup>1</sup>*

	Direct exposure		$\frac{1}{4}$ to $\frac{1}{2}$ mile <sup>2</sup>		$\frac{1}{2}$ to 1 mile	
	South and west	North and east	South and west	North and east	South and west	North and east
Area occupied by burned lands, brush, scrub, or plains areas; sum of all exposing areas (acres):	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	
100 or more.....	50	25	37½	20	20	None.
60 to 100.....	40	20	30	15	15	Do.
20 to 60.....	30	15	22½	10	10	Do.
10 to 20.....	20	10	15	5	5	Do.
Less than 10.....	10	5	7½	None	None	Do.

<sup>1</sup> Same in all classes. Does not apply to commercial blueberry areas, which take specific charge.

<sup>2</sup> Direct exposure through communicating forest areas only, as with slash; same principles apply.

5. *Commercial blueberry lands.*—Any area on which blueberry or huckleberry production is a commercial or semicommercial proposition, whether or not intentional burning has been practiced in recent years.

*Commercial blueberry-land charges, percents of class rate<sup>1</sup>*

	Direct exposure		$\frac{1}{4}$ to $\frac{1}{2}$ mile <sup>2</sup>		$\frac{1}{2}$ to 1 mile	
	South and west	North and east	South and west	North and east	South and west	North and east
Area occupied by commercial blueberry lands (acres):	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	
100 or more.....	125	62½	100	50	50	None.
60 to 100.....	100	50	80	40	40	Do.
20 to 60.....	50	25	40	20	20	Do.
10 to 20.....	25	12½	20	10	10	Do.
Less than 10.....	12½	6¼	10	5	5	Do.

<sup>1</sup> Same in all classes.

<sup>2</sup> Direct exposure through communicating forest areas only, as with slash; same principles apply.

6. *Dead or dying timber.*—Timber dead or dying from any cause. Charge required because of increased susceptibility. Applies only to classes 1, 2, and 4. Classes 3 and 5 are not insurable if dead or dying nor are they considered as measurably increasing the hazard to exposed insurable growth.

Susceptibility factor, if insured: Class 1, 25 percent; class 2, 30 percent; class 4, 50 percent.

No charge for exposure of insured growth by dead or dying timber. Classes 1, 2, and 4 are insurable only so long as they still retain a definite salvage value.

NOTE.—This charge is made only when more than one-half of the trees on an area of more than 10 acres are dead or dying.

Unexposed property rate: \_\_\_\_\_ cents.

CAUSATIVE HAZARDS

Charges for causative hazards are percentages of unexposed property rates. Charges are to be applied only when the agencies are directly on or within one-half mile of the insured property or when no water, cultivated fields, or other breaks as described above, intervene.

*Railroad (common carrier).*—Steam railroad through property or directly alongside south or west. If to north or east reduce charge one-half. If more than one-quarter mile away, reduce one-half. No charge for exposure more than one-

half mile away. If no steam locomotives are run on the line, reduce charge three-quarters. If only oil-burning steam locomotives are used, reduce charge one-half.

NOTE.—This does not include logging railroads which take the lumbering exposure charge.

*Exposure charges.*—Classes 1, 2, and 4, 15 percent;<sup>14</sup> classes 3 and 5, 20 percent.

*Lumbering.*—Logging operation, sawmill, pulp- or fuel-wood cutting, or other forest-exploitation activity on or directly adjacent south or west, or logging railroad through property or directly alongside south or west.<sup>15</sup> If north or east reduce charge one-half. If more than one-quarter mile away, reduce charge one-half. No charge if more than one-half mile away.

*Exposure charges.*—Classes 1, 2, and 4, 75 percent; classes 3 and 5, 125 percent.

Gross rate: ——— cents.

(Sum of all charges to this point.)

#### CREDITS

*Natural firebreaks.*—Rivers, lakes, or cultivated fields (not grass or grain). Credit applies to portion of property lying within one-half mile. If break is one-quarter mile wide or wider give full credit; one-eighth mile to one-quarter mile, cut credit one-fourth. Natural breaks less than one-eighth mile wide credited same as artificial breaks.

Credits for a break lying to south, southwest, west, or northwest, 20 percent of gross rate; north, northeast, east, or southeast, 10 percent; all around, 25 percent. If the break runs through the insured property credits apply on both sides as indicated.

*Artificial firebreaks.*—Fire lines, maintained as such and approved by the underwriter. Roads on which automobiles can be driven are in no cases to be considered as firebreaks. In order that credit may be given, the breaks must qualify as lines at which going fires would ordinarily be stopped with a minimum of back-firing. They must be so maintained that backfiring could be safely undertaken at any time without preparatory work.

Credits for break lying to south, west, or northwest, 10 percent of gross rate; north, east, or southeast, 5 percent; all around, 12½ percent. Credit given on both sides of interior breaks as indicated.

NOTE.—Credit for firebreaks is not given unless they (1) extend at least two-thirds of the distance across the property, or (2) are at least 1 mile in length. Internal breaks cannot give credit in more than two directions.

*Railroad patrol.*—When the railroad or logging railroad patrol warranty is attached to the policy.

Credits for common carrier railroads, three-quarters of railroad-exposure charge; for logging railroads, one-sixth of the logging-exposure charge.

*Shut-down of logging operation (or delayed start).*—If operations exposing the property are active during only part of the fire season, as defined, credit may be given as follows: Operation active less than one-half of fire season, reduce lumbering charge one-quarter; active less than one-quarter of season, reduce charge one-half. Full charge required if operation is active more than one-half the fire season.

Net rate, gross rate less credits; minimum rate, 20 cents; minimum premium, \$5.

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<sup>14</sup> Possibility of salvage in these classes.

<sup>15</sup> Actively in operation during any part of the fire season.

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