T H E S I S

FOREST FIRE INSURANCE

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INTRODUCTION

Forest fires cause widespread damage in American forests in spite of increasingly efficient and widespread use of protection systems. Largely because of the hazard of forest fires and other risks and the generally low income from even well managed forests, private landowners have been reluctant to go into forestry as a business undertaking. The ways generally suggested to make private forestry a paying business are governmental aid, more equitable taxation, and better protection (20). Governmental aid will probably help the cause of forestry materially through research programs, extension programs, etc. This is a long step in the right direction. The problem of more equitable taxation has been the subject of widespread study but so far nothing material has been done about this problem. Better protection is universally considered necessary to make private forestry pay and great advances have been made along this line. However there is a point of diminishing returns on reduction of risk from increased expenditures for protection.

There is one further possibility to encourage forestry as well as reduce the element of risk and give security against loss (31) that has not received the

practical attention that it deserves. This possibility is the use of forest fire insurance. Forest insurance has developed slowly probably because there has been no definite knowledge as to the hazard involved, but rather a grossly exaggerated idea of the costs of such insurance. Another reason for such slow development has been that reasonable standards of protection against fire or other harmful agents have neither been generally enforced by law nor adopted voluntarily by owners until comparatively recent times (31).

It is the purpose of this paper to gather the existing information about forest fire insurance so that its principles may be clearly understood, to show how these principles are applied, and to otherwise present a comprehensive picture of this field so that its possibilities may be evaluated and future trends predicted.

HISTORY OF FOREST FIRE INSURANCE

Europe

According to Shepard (33) insurance, as it is known today, had its beginnings in Italy near the beginning of the thirteenth century and was originally applied to the hazards of marine transportation. Evidence of practices quite similar to modern insurance, but not having all of its essential features, is found in historic records from as early as around 500 B.C.

Fire insurance, as it is known today, had its beginning in England in 1667. This beginning can be directly traced to the great fire of London of 1666, probably the greatest fire catastrophe of all history. The basic idea of true fire insurance germinated in the mind of a man named Nicholas Barbon, who had witnessed this conflagration and was deeply impressed by the widespread destitution following in its wake.

Barbon went into the fire insurance business and was successful. Others followed soon after so that in a relatively short time, fire insurance was being offered in England by a large number of separate organizations.

These organizations soon saw that it was to their interest to prevent and reduce losses from fire.

The result was the formation of fire brigades, salvage companies, and detection patrols maintained by the many insurance organizations as private business undertakings. In spite of the confusion and cross purposes that inevitably resulted from this system it lasted for 200 years and was not replaced by public protection in London until 1866. Then public protection was at last adopted, to be maintained at the taxpayers' expense; the telling argument in its favor was not, curiously enough, that of prevention of property loss but of the prevention of loss of life.

Heske (22) credits Forest Director Burckhardt of Hanover, Germany, with making the first proposal for forest fire insurance in 1877. According to Herbert (20) "the first forest fire insurance of record was written by stock fire insurance companies in France and Germany about 1880. These ventures were not very successful either from the point of view of the underwriter or that of the insured; volume of business was too small and premium rates too high." Forest insurance is still written in these countries today (3). One of the German insurance organizations in existence in 1938 was a mutual insurance enterprise in Bavaria, organized in 1920. However the members are not individuals, but are associations. The Germans feel that by having associations rather than individuals greater stability and liquidity are given the undertaking. This insurance is under the administrative

supervision of a State Ministry. The German State is interested in forest fire insurance "Because it is concerned in a healthy development of all branches of national economy." (22)

Holland has the distinction of having the oldest operating mutual forest insurance organization. It was founded at Zutphen in 1894 and has twelve classifications based chiefly on biotic hazards (20).

The first attempt at forest fire insurance in Denmark was in 1898. In 1902 the Danish Plantation Insurance Company was insuring forest property. Only plantations were insured, and liability was limited only to the cost of replanting the area burned (20). In 1931, 40,000 hectares of plantations were insured at a valuation of 16,000,000 Kr. (4).

There were attempts as early as 1878 to have forest fire insurance in Sweden. However their first successful company was the Veritas, organized in 1919 (3). Today Sweden has 70,000 to 75,000 forest owners who have insured about 8,000,000 hectares at a valuation of about 800,000,000 Kr. (4).

In Norway the Norwegian Mutual Forest Fire Insurance Company, organized about 1912 (20), has been very successful, and today has about 13,000 policy holders with 2,000,000 hectares of forest land which has an aggregate valuation of 400,000,000 Kr. (4).

In Finland there are several mutual forest fire insurance companies (20). The Sampo Mutual Insurance Company, founded in 1914, and the Forest Owners Mutual, established in 1916, together have about 30,000 policy holders owning an estimated area of 2,000,000 hectares with a valuation of 3,000,000,000 marks (4).

Other countries which have been more or less successful in forest insurance are Belgium and Switzerland, so that the business may be said to be reasonably well established in Europe (3).

United States

Forest fire insurance as such is a very recent development in the United States. Previous to 1916 policies were written only on the solicitation of the property holder for aid in floating bond issues or for the protection of odd lots of valuable timber for a few years (20). The first insurance company to actively solicit forest insurance in the United States was the Phoenix Assurance Company of London, England. In 1916 they began writing timber insurance in Washington and Oregon west of the Cascade mountains. Because of lack of demand this company discontinued its business there in 1918 (2). So far as is known, this is the only attempt at insuring standing timber on the Pacific Coast. However, in 1926, a group of ninety-one companies combined forming the Logging Insurance Underwriters' Association which was

later changed to the Logging Underwriting and Inspection Association, for the purpose of underwriting felled timber and logging equipment in the two states of Washington and Oregon. They did not solicit any standing timber insurance (3).

The first organization in the United States dealing exclusively in forest insurance was the Timberlands Mutual Fire Insurance Company which was incorporated in New Hampshire in 1917 (7). The company insured all kinds of timber but accepted its risks very carefully. After having been active for only seven months, the company dissolved in 1918, having "established the principle of timberland insurance and not being particularly interested in the commercial aspect of the matter." The business of the Timberlands Mutual was taken over by the Globe & Rutgers Fire Insurance Company (7).

In 1923 the Home Insurance Company of New York and its allied companies, the Franklin Insurance Company of Philadelphia and the City of New York Insurance Company, offered to write forest insurance with coverage restricted to forests in the northeast. In 1924 they were encouraged enough by their results in writing standing timber insurance to offer to write plantation insurance. This was the first progressive plan for the insurance of non-merchantable timber in the United States (20).

In 1924 the Automobile Insurance Company of

Hartford, Connecticut, offered forest insurance under about the same conditions and rates as the Home Insurance Company; but the offer was discontinued by the company early in 1926 (3).

According to the information available the only companies offering insurance to timber owners today are the Globe & Rutgers Fire Insurance Company and the Home Insurance Company of New York and its allied companies, the Franklin Fire Insurance Company of Philadelphia and the City of New York Insurance Company, and their writings are limited to the Eastern United States (3).

The Need for Forest Fire Insurance in the United States

It is estimated that forest lands privately owned comprise approximately four-fifths of the total area of such land remaining in the country, and that they carry more than 914,272,000,000 board feet of timber of merchantable size. The total commercial forest land ownership is 461,044,000 acres out of a total forest land area of 623,828,000 acres. (Gaging the Timber Resource of the U.S.,U.S.F.S., 1946).

One of the great problems facing us at the present time is that of reconciling the management of these privately owned forests with the requirements of sound public interest. It is highly desirable that their great public value be not dissipated further. There has

already been a great deal of harm done in this respect. The conditions under which forests will be managed with the end in view of sustained yield is a social necessity. It requires long-time planning to achieve sustained yield.

The possibilities of timber growing as a business have not been fully understood. There are several controlling factors involved, one of which is the relation of probable earnings to the safety of the investment, that is, other things being equal, demanded returns vary inversely with the safety of the investment (34). According to Shepard insurance serves its best purposes when the discount factors are difficult to measure and long-time ownerships are involved.

If the highest values are to be realized from forest lands improper use such as devastation, wasteful use, etc., should not be allowed. One factor which encourages liquidation is the fear of loss from fire before any value can be realized. This is the point where forest fire insurance can help in making more wise utilization possible.

Another factor not to be overlooked is the fact that financing of forest properties for the long periods necessary for sustained yield practices is difficult to obtain. By virtue of having insurance upon the forest property obtaining much better credit is possible (22).

INSURANCE PRINCIPLES

Theory of Property Insurance

All insurance is based upon the risk or uncertainty to which our present-day economic life is subject. Man in most cases endeavors to remove risk from his business undertakings.

According to Herbert (20), there are three classes of risks: (1) those that can be designated by a definite mathematical expression, (2) those that cannot be definitely foretold in advance but can be given an approximate value by the statistical study of past behavior, and (3) those risks which do not lend themselves to any orderly tabulation. We are concerned with property risks, especially fire, which falls in the second group. Fire risks can be averaged and given an approximate value.

There are various ways of removing the risks from such business ventures as are subject to risks. These are (1) elimination (protection, research, and similar means), (2) assumption by manager, and (3) by transferring the risk to others (20). From past experience it has been shown that a combination of all three of these is usually essential to reduce the uncertainty in any business to a satisfactory level. The third of these methods of removing risk by transferring it to others is usually known as insurance. Herbert states that insurance is a social device for accumulating funds with which to

meet what from the individual's view, are wholly uncertain economic losses, by combining and transferring many individual risks to one person or group of persons (19). The greater the number of risks combined, the smaller will be the percentage of variable loss, and hence, the greater the accuracy in determining the expected loss, and the cheaper the cost of the insurance (20). Thus, were it not for the managerial expenses included in the insurance premiums, property owners would never find it economical to carry self insurance, for the more risks there are in a group, the better the average.

Principles of Fire Insurance Applicable to Forest Properties

An insurance policy is a contract between an insurer, as party of the first part, and an insured, as party of the second part, under which the first agrees to make good to the second any loss or damage that may result from the action of some destructive agency or agencies named (34).

There are two essential features of a fire insurance contract (8), namely:

1. It is a contract of indemnity and does not contemplate that the insured shall reap any profit as a result of the damage or destruction of his goods by fire.

2. It is a personal contract insuring the person and not the goods under consideration.

In order for the terms of the contract to be carried out, the insured must have a legal insurable interest in the insured property and damage must have resulted as a consequence of the accidental operation of the agency insured against (34). The fulfilling of the contract terms then comprises an attempt on the part of the insurer to repay to the insured the equivalent of his insured loss to the exact extent that it is possible to determine it--no more and no less.

Obviously all action must be in good faith by both parties. The operation of the destructive agency must be wholly accidental so far as the insured is concerned. There can be no concealing of facts nor deliberate inciting of the destructive agency directly or indirectly. It is essential that the insurer protect himself by providing for the voidance of the contract when and if violations of these principles are proved.

Fire insurance is not, as is often believed, a substitute for fire protection. This would allow a slackening in the protective effort that would result in an increase in total loss. In its inherent nature forest insurance cannot function that way. All it can do is to supplement effective protection, carrying on from protection's point of diminishing returns and completing the job of protection of the financial investment.

The only direct effect that insurance may be

said to have on the protective effort itself is that it does alter somewhat the point of diminishing returns by absorbing the residual hazard that is left when protection has done all it can do economically.

The actual function of insurance is from one point of view, to lift responsibility for effective protection from the shoulders of the owner and to place it on those of the insurance carrier(34). Private protection is a matter of individual agreement between the two parties, but the ultimate responsibility for its effectiveness is still assumed by the insurer. This is inevitable because the insurer is the one who will lose if protection weakens. Therefore in order to maintain effective protection, insurance introduces a systematic, technical, and vigorous effort towards advancement of protective agencies and measures. Along with indemnity payments this is a recognized function of insurance.

Advantages of Forest Insurance

Insurance eliminates an element of uncertainty and replaces it with a definitely known and budgetable annual expense (34).

The advantage in forest fire insurance in making it easier to obtain credit has already been discussed. This is a very real and helpful advantage.

Another real advantage in forest fire insurance

is that it assists in bringing about adoption of better fire protective measures through reduction of insurance rates as the better fire protective measures are shown to be in force.

A last advantage in the case of family owned private forests is that inheritances are protected through the security of insurance.

FIRE HAZARDS

"Fire hazard in general is the sum of all factors affecting the fire risk of the forests." (3). Negative hazards are those that decrease the risk while positive hazards are those that increase the risk. A further division is internal hazards, or those within the boundaries of the forest, and external hazards, or those outside the boundaries. Under similar conditions internal exposures are the most dangerous because the fire starts on the property, while fires originating from external sources may be suppressed before they reach the property. In most cases it is safe to say that the greater source of fires is from external exposures, while from a loss standpoint the internal exposures carry the most risk (3).

There are many factors that control fire hazard. However the two most fundamental factors are the combustibility of the material within the forest and the agencies which start fires. There is a close relationship

between these two factors in that one is dependent upon the other to constitute a high hazard. The number of fires is controlled by the sources of ignition and the ignition point of the forest material, while the amount of damage is influenced by the degree in which the forest burns or susceptibility. It has been found that the degree of hazard on any individual forest property is only as great as its inflammability. If a high source of ignition is present it may be offset by a low degree of combustibility. These factors should be kept in mind in schedule making, and each exposure has to be weighted by the character of the adjoining forest cover (3).

Combustibility

Combustibility, as here used, refers to the ease of ignition and the rate of burning. The degree of combustibility is controlled directly by the amount of moisture in the forest material. The factors that are the most important in controlling moisture are climate, porosity of the soil, and character of the stand.

The factors of climate will not be discussed here.

Soils that are porous and contain little humus are fast drying and constitute a positive hazard. Soil of this type usually supports a rather open stand and has considerable brush.

Soils with a dense growth and much organic matter are usually wet or slow drying and are thus a negative hazard.

Topography controls the rate of burning to some extent and thus exerts some effect on combustibility. Southern aspects dry out earlier in the year. Forests on steep slopes usually burn more quickly and rapidly than those on flats. The draft from fires on steep slopes travels up the slopes drying out the material higher up, and carrying the flames along at a greater speed.

It has been found that forest types have different degrees of combustibility. Averill and Frost (3) worked out the following classifications in the descending order of combustibility.

Ease of Ignition

1. Open grassland or grassland on which plantations have recently been established.
2. Cut-over land on which slash has not decayed. All types of brushland (land supporting young hardwoods up to brush size, or woods shrubs).
3. Land supporting hardwoods above brush size.
4. Land supporting rather open, poorly stocked, softwoods.
5. Land supporting stands of softwoods, the crowns of which have closed.

Rate of Burning

1. Open grassland or grassland on which plantations have recently been established.
2. Land supporting stands of softwoods the crowns of which have closed.
3. Cut-over lands on which slash has not decayed. All types of brushland.
4. Land supporting hardwoods above brush size.
5. Land supporting rather open, poorly stocked, softwoods.

In considering the ease of ignition and the rate of burning as two distinct factors of combustibility, the order of rating under the two factors will obviously vary with all types except open grassland or grassland on which plantations have recently been established.

Amount of Damage as Related to Age, Composition, and Density

The amount of damage due to a spreading fire will depend largely upon the age, composition, and density of the stands of timber.

A dense stand of pine reproduction or a young pine plantation will incur the greatest damage, because in almost every case a hot fire will cause one hundred per cent loss for the area burned. The financial loss to the owner will depend upon the original cost of planting plus the interest rate up to the time of burning

(simple or compounded).

The amount of damage to hardwood stands under fifty years will depend upon the origin, species, and density. The density of the stand will largely determine the rapidity of spread and the intensity of burning, and thus the number of trees liable to damage.

Damage to hardwood or mixed stands of merchantable size will depend mostly upon their degree of stocking and their composition.

Because hardwoods are less fire resistant than softwoods, a hot surface fire will cause greater damage in a hardwood stand of merchantable size. Unless a fire reaches the crowns, there will be little damage in a merchantable softwood stand. Poorly stocked softwood stands above forty years of age are potentially the least liable to damage of all the timber classes (3).

Exposure Hazards

Exposure hazards are causes of fires or all agencies that may cause a fire (3).

The two fundamental causes of fire in most areas are man and lightning. The relative importance of each varies greatly from section to section and from area to area.

An analysis of the exposure hazards would be largely an analysis of the contact that man makes with the forests. On the assumption that the greater the

number of people coming into contact with the woods, the greater the chances of fire, it will be necessary to go into the distribution and number of people and all the means that bring the people into contact with the woods. The distribution and number of people will include all centers of population and their location. Next is the connecting link between the cities and the forests; the vast network of roads and railroads. Another is the use to which the forest is put, or use exposure. This is similar to the term "occupancy" which is employed in building insurance.

Population:

It is believed that the chances for fires increase directly with increases in population (3). However, the size of fires tends to decrease with an increase in population. This last phenomena is due in part to a more efficient fire protection system usually being available near the large centers of population, and in part to the fact that smaller, more scattered holdings are usually the case near the large centers.

Highways and Roads:

Highways and roads are closely connected with population, because only through them will the vast number of people come in contact with the woods. Statistics have shown that of the fires of known causes thirty-five

per cent are due to "smokers." (3). Statistics, however, do not show whether these people were in automobiles or actually on the forest property when they disposed of their "live" tobacco or match. From the number of roadside fires that have been caused by smokers, it has been assumed that a number of these people were in cars passing through the forests. The routes of main travel, such as state highways, are the most dangerous from the standpoint of bringing the most people into the woods. The next in importance are the improved town roads, and last are the unimproved, or dirt roads. The degree of danger from the town roads will vary with the intensity of their use. In most of the cases the danger will increase towards intersections with main state highways and in vicinities of the larger centers of population. Roads and highways as an indirect exposure hazard vary from a positive hazard for those of high usage to a negative hazard for those receiving little use. As for direct hazards, the degree of danger will vary with the degree of inflammability of the land adjoining the right-of-way. There can be no direct positive hazard if the highway runs through swamp lands or lands that are moist the year around. However, if there is an abundance of dry grass or other highly inflammable litter along the highway, the direct hazard can be very great.

Railroads:

Coal burning locomotives are a constant positive exposure hazard during dry seasons. As in the case of highways, there must be a moderate to highly inflammable fuel adjacent to the right-of-way before railroads are to be considered a high positive hazard. Although railroads in general are a high positive hazard, the financial loss to timber owners has been comparatively small. This is due to the fact that the railroad corporations are held liable for all damage from fires set by their locomotives.

Uses of Forests and Forest Lands:

The many uses of forests and forest lands introduce hazards which vary from positive to negative. Railroads and highway rights-of-way have been the most important and have caused the greatest number of fires.

Logging operations introduce another hazard mostly because of the greatly increased combustibility of the stand after the operation. Such operations open up the stand, allowing the ground cover to dry out more rapidly, and leave much debris which is very inflammable when dry. Open, cut-over forest land is the most dangerous type from a fire standpoint.

Careless burning of brush, rubbish, and grass has also caused numerous forest fires in most areas. Brush burning is often regulated by a state-wide permit

system. The laws are not always strictly adhered to, and lax enforcement accounts for brush burning at times becoming a high positive hazard. Rubbish burning has been important in the thickly populated sections. Fires from burning rubbish piles have often spread to adjacent forested areas. Grass burning has sometimes got out of control, but this is a minor source. Burning over brush and grass land increased the combustibility of the land. For a short period after the burning the combustibility will, of course, be less, but ultimately the results of burning will be an increase in the rate of drying out of the soil and an increase of brush cover.

Hunters, fishermen, and campers are the largest source of fires under recreational uses of the forest. If the hunting season comes in the latter part of the fire season it will make hunting the least hazardous of the three in most areas. Hazards from these sources have been decreased by posting the forest property according to state laws. This affects the internal hazard; but unless all surrounding land is posted, the external hazards of the property will not have been decreased.

Houses on or adjacent to forest property may or may not be a positive hazard, depending upon the character of the occupants. Children playing with fire have caused a number of forest fires. Other sources of fire from houses are land clearnig, rubbish burning, and general carelessness with fire.

Incendiarism:

Incendiarism is an unmeasurable moral hazard and the future number of fires from this source cannot be predicted upon past experience.

INSURANCE RATES AND RATING

Sparhawk, in his "Forest Insurance in Private Lands Under Management " (38), and in his "Suggestions for Rating Risks in Forest Insurance" (41), gives a comprehensive plan for the classifying and rating risks. He proposed that they be based on the following considerations:

1. The damage done by forest fires depends upon the area burned over, the value per acre of the burned forest, and the proportion of that value which is destroyed by fire.
2. The area burned over depends upon the number of fires that start and the average acreage per fire.
3. The number of fires that may start depends upon the presence or absence of causes of fire at the time when the firest is in condition to burn. This to some extent is modified by regional differences and by differences in character of the forest.

4. The average acreage per fire depends on differences in climate, in type of forest, in inflammability of forest as influenced by character and condition of the stand and ground cover, and in the effectiveness of suppression organization.
5. The proportion of the total value of forest burned over that will be destroyed by fire depends upon the climate, and upon the type, age, and condition of the forest.

At the same time the Committee on Forest Fire Insurance of Commercial Forestry Conference (2) reported that in order to have a proper base for rating forest fires for insurance purposes the following factors should be investigated:

1. Investigate the susceptibility of all species to fire at various ages and find all possible salvage values.
2. Investigate means for collection of average annual losses by area, volume, species and value, and compare them all with the total values.
3. Investigate what the relative risk is according to the location in relation to railroads, towns, highways, etc.

4. Investigate means for tabulation by percentages of the various causes of fires.
5. Investigate means for determination of the numerical frequency of fires and what the average extent is sectionally.
6. Investigate the efficiency of the various forms of protection.
7. Investigate means for the determination of the amount that is spent per year per acre for fire protection and what the values covered are.
8. Investigate the relative risk of old growth, second growth cuttings, and plantations.
9. Investigate the factors of slash risks and the length of time for slash to decay.
10. Investigate the effect of prevailing winds on fire risk.
11. Investigate humidity relations with forest cover and other hazards.
12. Investigate the average cost of field inspections.

These basic factors are used in determining the rating schedules from which all property insurance premiums are determined. These schedules are based upon one or more basic charges to which there are made additions and subtractions for differences in the hazard.

They have to be drawn up by experienced underwriters who rely upon their judgment and experience as to what the charge for a particular hazard should be. The lack of proper statistical records makes it practically impossible to determine rates from past experience, and companies, for this reason, hesitate in adopting experience ratings. However if rates cannot be based upon experience in ordinary fire insurance, it is obvious that experience rating in forest insurance is at present also impossible. Forest fire statistics have been at best unsatisfactory (20). There has been little collection of the data that must be available if insurance rates are to be formulated from actual past experience. In the words of Sparhawk (4), "Our fire records are incomplete, inaccurate, and lacking in uniformity, and do not in most cases give the details necessary for proper classification while our knowledge of the values at stake is even more deficient." Sparhawk recommended a central actuarial bureau, but until recently little headway has been made either in the method of collecting the data, its accuracy, or its compilation.

The existing methods of collecting forest fire data are often fundamentally wrong (20). The appraisal of the value damage by local fire personnel is particularly objectionable. There are few local fire personnel who have a good conception of the principles underlying the determination of value in non-merchantable timber,

and, as a result, such losses are seldom reported. A similar condition prevails to a greater or less extent in every organization collecting fire data in this country. Furthermore, the man in the field should not be asked to make estimates that require both considerable time and technical training. His efforts should be directed mostly toward prevention and suppression (20).

It is impossible under present conditions in most areas to send a special appraiser to each fire, but, even now, it would seem that large fires could be handled in this way. For the average fire, the report must still be compiled by the local fire personnel, but the data called for can be clarified. The area burned over should be tabulated by acres, or even better, on larger irregular fires, by metes and bounds accompanied by a rough sketch map. The average diameter, the species and density of the trees, and the site should be listed, together with the approximate number of trees damaged or killed (20). The elapsed time and other data now customarily collected for each fire to determine the efficiency of the protective organization, and to determine various factors of hazard are generally satisfactory where it is used. A report covering the points enumerated above can be filled out with greater accuracy by the average state or private fire personnel than the ones now in use (20).

The data collected should be transmitted to a

forest actuary who is not only well acquainted with the localities from which the reports come but who is also thoroughly familiar with the subjects of forest valuation and statistical methods. The tabulations made by him should be by regions, types, age groups, and causes. While it would, doubtless, be best to collect and tabulate the data not only by these groups but also as Sparhawk suggested (pp. 23-24), by degrees of occupancy and exposure hazard, it is questionable whether the field man should at this time be burdened with such additional work. Not only does it mean more time to fill out the report but it also would tend to make the reporter careless and indifferent toward the entire report because the information desired is so indefinite. Nor could uniformity be had because no rigid rules can be laid down with our present knowledge, and each man would have to rely upon his own judgment as to the grades of hazard. It seems that such detailed statistical methods will have to await the time when all major fires will be appraised by a trained forest actuary (20).

It has been argued, too, that the damages should be expressed in units of measure instead of monetary units or, if monetary units are used, they should be fixed for at least a decade and should not fluctuate according to changes in market prices (41). It must be remembered, however, that basic data should be collected

so it can be tabulated in such form as to lend itself to various interpretations. Thus, primary tabulations of loss can be in units of measurement from which any monetary value desired can be calculated. Protective efforts should be tabulated by man-hours. It cannot be urged too strongly that changes in statistical methods be made only after thorough and painstaking consideration according to Herbert (21).

There has been a dearth of statistical studies. This is chiefly due to a lack of data or, if available, they have generally been very unreliable and not susceptible to statistical analysis. For insurance purposes, the period of time covered by the data at hand is so short as not to be of much value in determining rating sshedules.

In his work on "Standing Timber Insurance" Shepard suggests the following outline for determining rates for the forests in the Adirondacks (30):

Basic rate . . . . . .$0.50 per $100

Cultural features on or within ½ mile of the property

	Plus	Minus
Railroad (steam)	$0.20	$....
Patrol system	....	0.10
Railroad (oil burning)	0.10	....
State highway	0.40	....
Dirt road surface	....	0.20

	Plus	Minus
Industrial establishment	$0.20	$....
Camping sites	0.15	....
Within 3 miles of any town or hamlet	0.10	....

Protective features

	Plus	Minus
System of patrol	$....	$0.05 to 0.10
Four-fifths of the property visible from lookout towers not over 10 miles away	....	0.10
Less than 4/5 visible but over ½	....	0.05
Land posted against trespassing or (not both)	....	0.10
Land posted with fire notices	....	0.02

Nature of stand

	Plus	Minus
Plantation under 25 years of age		
Conifer	$0.30	$....
Broadleaf	0.15	....
Natural young growth, under 25 years		
Conifer	0.30	....
Broadleaf	0.15	....
Other pure coniferous stands	0.10	....
Swamp type	....	0.05
Swamp type in other than conifers	....	0.05
Owner or agent residing upon property during fire season	....	0.05

"Under this schedule the maximum rate possible would be $1.95 per $100 for a coniferous plantation under twenty-five years of age, having no protective features, and being subject to all the hazards listed. The lowest rate would be for a hardwood or mixed stand located in a swamp, subject to none of the specific hazards, but having the maximum patrol and lookout protection. The rate for such property, if the owner or his agent resides thereon, would be 10 cents per $100. The basic rate in the above schedule was mathematically determined from existing statistics (being set at about 100 times the known burning rate for the region), and to the rate thus derived was applied a safety factor of 300 per cent. This safety factor is necessary to cover both inaccuracies in the statistics and increased costs due to a possible lower demand than anticipated. In other words, the basic premium rate used is the actual average rate plus a safety factor of twice the premium."

EVALUATION OF PROPERTY

Insurance premiums have been ordinarily based on the sales value of the property insured. This value would have to be determined by the owner as it is usually too expensive for the insurance company to appraise the property before issuing a policy. If a loss occurs, inspection would usually be undertaken by the company to determine the true value before and after the fire. In

the case of most property, the owner is usually well aware of its approximate value; but there are few people who have any idea of the value of a stand of timber that is not yet merchantable. This has been one of the most difficult problems of the forest insurance business and is one of the reasons for its slow development (20).

In immature forests when future value is discounted to the present time it is commonly known as expectation value. Merchantable value refers to the value of the products that can be secured at any one time from any particular stand of timber. In the past sales value has usually been measured entirely by merchantable value. Farsighted individuals are now beginning to realize that a tract of timber, if allowed to go on growing, will in time be worth more than the present merchantable value, plus future expenses and compound interest at the usual rate. If there is sufficient competition in buying the timber, the sales value will rise to the true or expectation value which will, of course, be the future value discounted to the day of the sale at a going rate of interest (20).

The future value used will be the merchantable value at that age when the timber as a growing crop will cease to return the usual rate of interest on the investment. When this age is reached for any particular stand, the expectation, sales, and merchantable values will be

the same. If the timber is not cut then, the value, while increasing for a time, will not increase as fast as the costs. The age at which these values first meet can best be termed the age of economic maturity (20).

In Europe, the general public has already learned to appreciate the potential value of immature timber to a degree that the difference between the true value of trees over one-third rotation age and their sales value has become small and progressive insurance companies have been able to determine the valuation for such stands (29). However Europe, even with its century-long experience, cannot use expectation value for stands younger than one-third the age of economic maturity. This is due to the fact that long periods must be covered by the calculations. European foresters and insurance companies have found it necessary in such cases to base their values not on the expectation value but on replacement value, which make up the cost of planting and other expenses, with compound interest to date (20). To prevent frauds, such as padded expenditures, a maximum figure has to be set which is not as high as the expectation value. Young, naturally seeded stands, when insured at replacement value, will include the average cost of planting for the region insured in.

Insurance companies in America cannot adopt the method of valuation used in Europe without radical modi-

fication, because the valuation of our immature timber by expectation and replacement value may be much higher than the market value because this would encourage incendiarism. Insurance value, in general, must correspond to market value. Under certain conditions, plantations may be insured at replacement value. Where the plantation has changed hands, the purchase price can be used as the insurance value.

It has to be remembered that forest plantations are worth no more than nautrally stocked stands of the same species, age, and condition. The true value should not be based on past costs but on future value.

In most areas where stands are under one-third rotation age, the best that can be offered by insurance companies is to insure on the replacement value, covering only such items as taxes, interest on bare land value, and such costs as protection and administration, all carried at the going rate of interest to the present age of the stand. The number of years that are to be used in computing the age should not exceed the average age of the timber. Deductions will also have to be made for density and condition of the stand. If the market value is greater than the replacement value, such value would be used; however on the other hand, if market value is less than the replacement value, percentage deductions will have to be made wherever necessary to prevent moral hazard (20).

In either natural stands or plantations which are over one-third rotation age, average sale values for the several regions must be determined, and these revised upward as the general public begins to realize the true value of immature timber.

Forest insurance valuation, as long as insurance is a volutary act, cannot ordinarily rise above sales value. The face value of the policy is simply the maximum loss for which the company can be held liable and that the actual value before and after the fire has to be determined on the ground by the adjuster.

ADJUSTMENT OF LOSSES

To prevent a misunderstanding as to the damage caused by a fire, a careful statement should be drawn up giving in detail the method to be used in adjusting the loss (29).

The peculiar conditions prevailing with respect to forest fire insurance makes rapid loss adjustment practically impossible. This is due to the fact that it is usually not possible to tell what will be the damage until a considerable time after the fire. Trees will often require a year or more to show definitely whether or not they have been damaged or killed by a fire. It is usually the best practice to delay damage appraisal until it may be definitely determined whether any individual tree is damaged or undamaged, alive or dead (34).

It is probably safe to say that there will be no difficulty whatever, in appraising damage in most regions at the end of the next growing season succeeding the date of the fire.

Where damage is confied to young plantations or natural reproduction, this wait will not always be necessary, but it should be the rule if the trees involved are more than 15 or 20 feet high (34).

Any experienced timber cruiser who is familiar with the crusing technique of a region can make satisfactory damage appraisals with very little extra instruction.

It is necessary to know what the quantity and quality of the immediately liquidable or speculatively held timber was prior to the damage, and the quantity and quality of that remaining. Accurate determination of the area that is burned is essential. Mapping work must, of course, make accurate location with respect to the legal survey, in order that proper check may be made with the coverage in the policy and the assured's title (34).

Where speculatively held timber is lost there will often be no immediate prospects of salvage, and the index of the indemnity will be the full amount of the timber killed or damaged. The title to the damaged portion of the timber passes to the carrier who has paid the indemnity, so that he may get what benefit may be derived

from future salvage possibilities (34).

The damage in timber capable of immediate liquidation is the difference between its value prior to the fire and the salvage value after. There is always some loss due to degrade and increased breakage, and this increases during the time between the fire and the time of cutting for salvage. As this period lengthens, the effects of decay and other deterioration will greatly increase the total amount of damage (34).

In adjusting losses on timber near active logging operations, which would be cut within a few years in any event, the adjuster will have to always endeavor to persuade the assured to modify his cutting plan so far as he can without undue expense, so that the salvage realization may be as large as possible. If an owner is not insured he will always try to salvage his burned timber as quickly as possible. The present of insurance protection should not cause this practice to be modified. The adjuster should not try to enforce salvage in a manner different from that which the assured would have adopted without insurance; but, on the other hand, slackness on the part of the assured should not be allowed. The standards of salvage will have to be the same whether or not insurance protection is maintained (34).

The practice of basing adjustments on the "woods run" or "camp run" should be closely adhered to. It

should be noted that although the assured sells logs, he buys trees, so that, while quality must of necessity be taken into consideration and the proportions of the total volume in no. 1, no. 2, and no. 3 logs admitted as an indication of quality, nevertheless the terms of the policy presuppose the reimbursement of the owner in standing trees, and an average should always be struck before making the final calculation. If agreement can be reached between the assured and the adjuster as to what the average quality of the damaged timber is the unit value can be established prior to the determination of the extent of the damage. The evidence that is contained in previously made cruise reports may be acceptable. The assured's own records of actual cutting on adjacent areas may give sufficient indication or there may be other methods of arriving at this information (34).

If, however, there is no basis for agreement as to quality prior to the production of figures by an adjustment cruise of the burned area, the agreement as to extent of damage and unit values involved will have to be made at the same time. It will probably always be necessary for the extimator of the extent of damage to also determine the qualities involved, even if for no more than a rough check. (34).

It will undoubtedly be essential that representatives of both parties be included in the damage-cruising

party. Whether they should always be invested with the power of arbitrators and should, between themselves, choose a third, it is not at present possible to state. However there are some very apparent advantages, in such a practice. Unless the insured and the adjuster contemplate doing the actual field cruising work themselves and agreeing as they go, it would appear that two cruises would be necessary, one for the assured and one for the carrier. This duplication can be avoided by the appointment of one cruising party with power of arbitration, its findings to be binding on both parties (34).

LOSS COST

After the value of the forest property has been determined by timber surveys and the total damage has been determined by damage appraisals, the next step is to determine the average annual valuation and the average annual fire loss for the period being studied. These are merely averages for the number of years in the period. The loss cost is the ratio between these two averages and may be expressed by the following formula, which gives the loss per $100 value of timber (3):

$$\text{Loss cost} = \frac{\text{average annual loss} \times 100}{\text{average annual valuation}}$$

INSURANCE FORMS

In writing forest fire insurance it will be necessary to have separate policy forms for the various regions and possibly even for the different classes of trees such as merchantable size, unmerchantable size, and plantation trees. Following is an example of the forms used by the Timber Lands Mutual Fire Insurance Company (7):

TIMBER LANDS MUTUAL FIRE INSURANCE COMPANY

Portsmouth, New Hampshire

Application for Insurance on Standing Timber

(Where Tracts are Separated, use one blank for each tract)

1. Name of Applicant.....
2. Address:.....
3. Location of Timber: State.....;County.....
   Town.....Range.....;Lot No.....
4. Timbered Area.....Acres.
5. ESTIMATE OF TIMBER TO BE INSURED:--
   (a).....Acres of merchantable green standing timber of six (6) inches or greater diameter at four and one-half (4½) feet from the ground.

KINDS OF TIMBER	1,000 FEET B.M. OR CORDS	VALUE PER 1,000 FEET OR PER CORD	TOTAL VALUE $	AMOUNT INSURANCE DESIRED
TOTALS.....				

(b).....Acres of planted land.

KINDS OF TREES	ACRES	NO. TREES PER ACRE	YEAR PLANTED	VALUE GROWTH PER ACRE	TOTAL VALUE $	AMOUNT INSURANCE DESIRED
TOTALS						

(c).....Acres of young growth, natural reproduction on sprout land.

KINDS OF TREES	ACRES	NO.TREES PER ACRE	YEAR PLANTED	VALUE GROWTH PER ACRE	TOTAL VALUE $	AMOUNT INSURANCE DESIRED
TOTALS						

6. TOTAL AMOUNT OF INSURANCE DESIRED ON THE ABOVE TRACT $.....

7. Have there been any logging operations on this tract during the past 5 years?....Dates?....Were tops and branches disposed of?.....How?.....

8. Will any part of this tract be logged during the next 12 months?.....During What months?.....

9. Have there been any fires on this tract during the past 5 years (Give dates, causes, kind of growth damaged and amount of loss in dollars for each fire).....

10. Is this tract regularly parolled by a fire warden?.... By any of your employees?....Between what dates?.....

Who is directly responsible for maintenance of patrol and fighting fire should it occur on this tract?.....

11. How far is this tract from the nearest railroad?....

12. Do you or any of your employees or other responsible persons reside on this tract?.....

13. Is this tract frequented by hunters, fishermen or campers?.....

14. Is there any recent slashing or other extraordinary fire hazard on the lands immediately adjoining this tract? (Give details).....

15. Is there an authentic cruise and plan of this tract?.....

16. Loss, if any, payable to whom?.....

Signature.....

Date....., 19....

It is understood that this Company assumes no liability for losses upon these tracts until the said Company shall have actually issued a policy or policies in accordance therewith or shall have notified the applicant in writing that his risks are accepted.

If possible MAKE SKETCH PLAN BELOW OR ON SEPARATE SHEET SHOWING THE FOLLOWING:----

General shape and dimensions of tract.

Area of standing timber.

Area of plantations.

Area of young growth, natural reproduction.

Area totally or partially cut during the past five years.

Area burned over during the past five years.

Area of cleared land.

Location of buildings, roads and fire lines.

Whether adjoining land is in timber, plantation, young growth, cleared, cut over or burned.

Locations of railroads if within two miles of tract.

Another example of a forest fire insurance form is a tentative one worked up by Shepard (34) for use in the Douglas Fir and Redwood regions. Following is his suggested policy-rider form for this region:

FOREST PROPERTY INSURANCE--DOUGLAS FIR AND REDWOOD REGIONS

(Front of form)

$.... On standing timber of merchantable size and of the following species (and no others).....

.....

$.... On standing timber of unmerchantable size and of the following species (and no others).....

.....

$.... 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 merchantable size" shall be construed to mean such portions of living trees of 16-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 unmerchantable size" shall be construed to mean living trees of 3 feet or greater height, but not exceeding 16 inches in diameter at 4½ feet above the ground and sufficiently free from decay and other seen and unseen defects as to possess a potential market value, unless otherwise noted hereon.

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

This policy does not cover any species or varieties of timber or growth on property 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 and/or plantation trees before the fire and the salvage value of the said timber and/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 herein-above referred to shall be any parts of the months of April, May, June, July, August, September, and October.

It is understood and agreed and made a condition of this policy that if cutting be commenced or continued 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, of 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.

.....,
Agent.

(Reverse of form)

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, not more than $.... per M. be. ft.

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.

REDUCED RATE AVERAGE CLAUSE: In consideration of the reduced rate at which, and the form under which this policy is written, it is expressly stiuplated and made a condition of the contract that, in the event of loss, this company shall be liable for no greater proportion thereof than the amount hereby insured bears to one hundred percent (100%) of the actual value of the property described herein at the time when such loss shall happen, nor for more than the proportion which this policy bears to the total insurance hereon.

THREE-QUARTER VALUE CLAUSE: It is understood and agreed to be a condition of this insurance that, in the event of loss or damage by fire to the property insured under this policy, this company shall not be liable

for an amount greater than three-quarters (3/4) of the actual cash value of each item of property covered by this policy at the location and as of the time immediately preceding such loss or damage; and in the event of additional insurance, then this company shall be liable for its proportion only of three-quarters (3/4) of such cash value of each item insured not exceeding the amount insured on such sites. Total insurance is hereby permitted for and limited to three-quarters (3/4) of the cash value of the property herein described and to be concurrent herewith.

.....,

Agent.

Shepard in his recommended application forms followed the same general outline as used by the old Timberlands Mutual Company but went into greater detail as to actual conditions and classifications of the timber on the ground.

SUMMARY AND CONCLUSIONS

INTRODUCTION:

There is a widespread need for forest fire insurance in the United States. It is the purpose of this paper to present a comprehensive picture of the forest insurance field.

HISTORY OF FOREST FIRE INSURANCE:

Europe: Fire insurance began in England in 1667. The first proposal for forest fire insurance was in Germany in 1887, the first written policies came there in 1880. There exists extensive forest fire insurance in the Scandanavian countries.

United States: Practically no forest fire insurance prior to 1916. A small number of companies offered policies after this time but no great successes were achieved. No companies are actively soliciting forest insurance at this time.

INSURANCE PRINCIPLES:

Insurance is a method of removing risk by transferring it to others through the insurance contract. It has the advantages to the owner of eliminating an element of uncertainty as to amount of annual expense from loss, makes it easier to obtain credit, aids in providing better fire protection, and protects inheritances.

FIRE HAZARDS:

Fire hazard is the sum of all factors affecting the fire risk of the forest. They can be negative or positive. The most fundamental controlling factors are combustibility and the agencies which start fires.

INSURANCE RATES AND RATING:

Insurance rates or charges are based on schedules which consist of one or more basic charges to which there are made additions and subtractions for differences in the hazard. There remains a great deal of work to be done in this field.

ADJUSTMENT OF LOSSES:

Rapid loss adjustment is impossible because it sometimes takes a year or more to determine the actual loss in trees. A statement of method of adjustment is essential in the policy.

LOSS COST:

$$\text{Loss cost} = \frac{\text{average annual loss} \times 100}{\text{average annual valuation}}$$

INSURANCE FORMS:

Separate policy forms are necessary for the various sections and regions of the country.

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