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HENRY S. GRAVES, Forester.

FOREST FIRES:

THEIR CAUSES, EXTENT AND EFFECTS, WITH A SUMMARY OF RECORDED DESTRUCTION AND LOSS.

BY

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FOREST FIRE ON SLEEPY RIDGE, WALLOWA NATIONAL FOREST, OREG., AUGUST, 1911.

LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
FOREST SERVICE,
Washington, D. C., July 13, 1912.

SIR: I have the honor to transmit herewith a manuscript entitled "Forest Fires: Their Causes, Extent, and Effects, with a Summary of Recorded Destruction and Loss," by Fred G. Plummer, Geographer, and to recommend its publication as Bulletin 117 of the Forest Service.

Respectfully,

HENRY S. GRAVES,
Forester.

Hon. JAMES WILSON,
Secretary of Agriculture.

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CONTENTS.

ILLUSTRATIONS.

PLATE.

TEXT FIGURES.

FOREST FIRES.

SOURCES AND SCOPE OF INFORMATION.

Forest fires in the United States have caused an average annual loss of about 70 human lives,[1] the destruction of trees worth at the very least $25,000,000, and the loss of stock, crops, buildings, and other improvements to the amount of many millions more. To these must be added enormous losses from the destruction of young tree growth, deterioration of the soil, damage to watercourses and adjacent property by low water and flood, interruption of business, and depreciation of property. By inquiry into the causes and extent of such fires we are able to realize in some degree the magnitude of these losses, even though their amount in dollars may not be appraised.

The first compilation of forest-fire statistics for the whole United States was by Prof. C. S. Sargent for the year 1880, published in the Tenth Census Report, Vol. IX. Data were given for 43 States and Territories, which, though necessarily incomplete, formed the best record then in existence. Unfortunately the Eleventh, Twelfth, and Thirteenth Censuses did not continue the compilation, and it is therefore not possible to compare data for different decades collected under similar conditions.

In 1891 the Division of Forestry of the Department of Agriculture collected statistics of forest, prairie, and crop fires. The data were incomplete and unsatisfactory, but they showed that during that year about 12,000,000 acres of forest had been burned and that property other than forest had been damaged to the extent of $503,590. The loss from prairie fires to crops, tree growth, buildings, and other property was reported by the same correspondence at $1,633,525. What proportion of the actual destruction these reports represented was not known.

The Chronicle Fire Tables for the year 1900 report a loss of $2,246,000 from forest fires. This figure, compiled by insurance companies, covers principally the damage near or affecting insurable property.

In 1900 and 1901 the Division of Forestry made a second attempt to gather statistics upon which damage from forest fires might be

[1] Very incomplete data for the past 50 years show 2,938 persons burned to death in forest fires.

estimated. All available sources were searched, including the files of old newspapers and magazines. While the results covered the greater part of the United States and Canada and extended over 100 years of time, they were obviously not complete, nor is the extent of their incompleteness known.

These attempts to compile statistics were made at the end of the decades following 1880, and the present bulletin is prepared at the close of the third decade. In gathering the data not only have these former records been drawn upon, but data from every other available source, and for which it is impracticable to give due credit, have been freely used.

New data have been obtained from—

(1) Reports of fires on National Forests.

(2) Reports of State foresters from 17 States.

(3) Supplemental reports of forest supervisors on fires outside of National Forests.

(4) Reports of lumbermen's associations.

(5) Newspaper accounts from press-clipping bureaus of recent fires.

(6) The Forest Atlas. This is the central map system of the Forest Service and contains manuscript maps showing old and recent burns, statistics, reports, history, etc.

(7) Investigations of Forest officers, particularly in even-aged forests, to determine by stem analysis the dates of old burns.

Before this mass of material could be used it was necessary to reduce the record of each event to a common standard, and a card system was devised, as shown below:

Sample of U. S. Forest Service fire record.

KIND OF FIRE: FOREST—BRUSH LAND—PRAIRIE (CHECK MARK PROPER TERM).

LOCATION OF FIRE: STATE, *New York*. COUNTY, *Essex*. NEAR *West Moriah* P. O.

DATE OF FIRE: YEAR, *1845*. MONTH, *June*. DAY (OR DAYS), *10*.

Origin of fire, *unknown*.
Area burned, *50,000* acres. Timber burned, ... board feet.
Value of timber burned, *$300,000*. Value of other property burned, *$17,000*.
Number of buildings burned: ..... houses, ... barns, *11* mills, and ..... others.
Number of lives lost, ... Number stock lost: ..... cattle, ... horses, ... sheep.
Remarks: "*Immense quantities of boards, shingles, lumber of all kinds, produce, houses, barns, and sheds.*"

The above information is furnished by *National Intelligencer, page 3, col. 4.*
Date 6-30-1845.

Even though these records do not include every fire that has occurred, some fair conclusions can be drawn from them. The causes and effects of fires at one period may be compared with the causes and effects at another period, notwithstanding that the total number and extent of fires are unknown. Moreover, the missing data for any decade may be interpolated and reasonable totals estimated. Such totals will, however, never represent the full damage.[1]

ANCIENT FIRES.

It is probable that forest fires have occurred ever since there were forests. When wood has been reduced to charcoal, its structure may be preserved indefinitely. It is in the coal formations that some of the earliest evidences of fire may be found, while a substance resembling charred wood has been unearthed in a subcarboniferous sandstone, on the eastern side of the "Thumb" of Michigan. Wood found in the Pleistocene formation "showed the effect of fire, indicating the result of a forest fire."[2] The charcoal of peat bogs in North America and New Brunswick, some of which are estimated to be from 2,000 to 3,000 years old, also indicates the occurrence of forest fires in the far distant past. Thus, step by step, from the subcarboniferous sandstone to the quaternary peat, charcoal presents its evidence of fire, just as the unbroken record continues from trees older than the peats to those of the present day.

Fire-scarred California bigtrees indicate that great fires occurred there in the years 245, 1441, 1580, and 1797. Evidence has been found of forest fires that occurred in Colorado[3] during 1676, 1707, 1722, 1753, and 1781, and also of numerous ancient fires in the Black Hills, S. Dak., the earliest of which is estimated to have occurred in 1730. So, too, in the region south of Mount Katahdin, Me., proofs were found that a forest fire covering an area of about 200 square miles occurred in about 1795.[4]

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[1] As an example of this, Mr. W. T. Cox, Minnesota State forester, writes: "The old data regarding forest fires in Minnesota are apparently valueless, unless it is to show that during certain years fires were more prevalent than during others. We know, for instance, of certain fires which did millions of dollars' worth of damage no reports of which were included in these summaries. * * * Even the figures for 1910 are away off. I notice they are given at $1,721,752. As a matter of fact, we had one fire in the fall of 1910 which did several times that amount of damage, in Beltrami County, and there were dozens of other large fires in northern Minnesota the same fall, none of which seems to have been reported. * * * These old reports did not give more than from 10 to 25 per cent of the loss in merchantable timber alone, and we have no way now of getting at the actual figures."

[2] Notes on Tertiary Plants from Canada and the United States, by D. P. Penhallow, Proceedings and Transactions of the Royal Society of Canada, p. 73, 1905.

[3] Forest Service Bulletin No. 79.

[4] In the several petrified forests the woody structure of the tree trunks has been entirely replaced by silica, the annual layers of growth, however, being clearly traceable. If carbon, indicating a fire scar, is present in any specimen, the fact has not been recorded.

It seems reasonable to assume, and the assumption is supported by some evidence, that fires destroyed the forests that probably once covered the great prairie region of the Middle States, some of the barrens of Canada, and the present extensive "parks" in the Appalachian and Rocky Mountain regions. This belief is held because trees will grow in these open areas when given encouragement and protection. Geologic evidences also support the view that the entire United States, below the Alpine summits, has, at one time or another, been forest land.

CAUSES OF FIRES.[1]

At least two causes of fires operated in ancient times—lightning[2] and Indians. The practice of Indians in firing forests, prairies, or swamps was to permit the growth of berries, to drive game, and occasionally to impede an enemy. That this practice was continued long after the advent of the whites is shown by many accounts of such fires in the early history of America.

Forest fires may be divided into those caused by man and those caused by lightning. A natural division of the fires caused by man separates those which are intentional, or incendiary, from those which are unintentional. Since by far the greater number of forest fires are of unintentional origin, these latter have been further subdivided, as shown in the following classification:

[1] It is very desirable that all statistics of forest fires be kept in a uniform manner. Some States and organizations, in reporting the causes of fires, use terms which have practically the same meaning but which may be interpreted differently. As the value of a fire record depends upon the field report, it is necessary that there should be a uniform method of assigning the causes of fires. The scheme of classification in the Forest Service is both simple and logical and is recommended for general adoption.

[2] Forest Service Bulletin 111.

Classification of the causes of forest fires.

[The heavy-face type shows the terms used in reporting the causes of fires.

- **FOREST FIRES**
  - Preventable; caused by man
    - Intentional ..... **Incendiary.**[1]
      - Maliciousness or willful negligence.
      - Contempt for the law.
      - To cover crime.
      - To drive game.
    - Unintentional
      - Sparks or ashes from engines
        - **Railroads.**[2]
          - Passenger, freight, and work engines.
          - Steam shovels and plows.
          - Logging engines.
        - **Sawmills.**[3]
          - Permanent mills.
          - Temporary mills.
          - Portable mills.
          - Donkey engines.
      - Generally from uncontrolled fires
        - **Brush Burning.**[4]
          - Clearing lands or rights of way.
          - Slash, rubbish, or garbage burning.
          - Stubble or meadow burning.
          - Light burning.
        - **Campers.**[5]
          - Construction campers.
          - Recreation parties and picnickers.
          - Fourth of July parties.
          - Miners and prospectors.
          - Hunters and fishermen.
          - Stockmen, including branding and protection fires.
          - Berry pickers and nut gatherers.
          - Cruisers, surveyors, and river drivers.
          - Smokers, children, tramps, drunks, lunatics.
        - **Miscellaneous.**
          - Fires from burning buildings, or from prairie or other fires, if the origin of the original fire is not known. If origin can be determined it is classified accordingly.
          - Sparks from chimneys, and stacks other than those classified under "Railroads" and "Sawmills."
          - Blasting, except as covered by the classification "Brush burning."
          - From electric wires, unless accompanied by lightning.
          - Spontaneous combustion, either chemical or mechanical.
  - Generally unpreventable..... **Unknown.**
    - Includes fires the cause of which is not determinable with reasonable certainty.
    - **Lightning.**

[1] Includes all fires that are intentionally set or due to willful negligence, but not those due to carelessness, mischief, or ignorance. "Intentional," however, does not include back-firing with good intent, which is classed according to the origin of the fire being fought.

[2] Includes all fires caused by sparks or ashes from traction locomotives, but not from clearing of rights of way, which are reported under "Brush burning."

[3] Includes sparks from stationary engines, but not fires from logging locomotives nor from loggers while slashing, clearing, cooking, or river driving.

[4] Includes all fires incidental to the removal of litter or undesirable growth, unless willful negligence is evident, in which case it is "Incendiary."

[5] Includes fires due to carelessness, mischief, or ignorance and fires started by Indians, but not fires started to drive game or to increase the grazing area. Such are "Incendiary."

In order of their importance, the following are the chief known causes of fires on the National Forests: Railroads; lightning; campers; brush burning; incendiary; sawmills.

Lightning is responsible for about 17.5 per cent of the fires. Other natural causes are extremely rare, and are not entitled to special recognition, but are included in the classification among "Miscellaneous" when their nature is known, or among the "Unknown" when it can not be determined.

Municipal fire statistics contain many interesting cases of fires originating in unusual or seemingly impossible ways, many of which could operate in the forest as well as in the city. "Spontaneous combustion" is a rare cause, and though no one seems actually to have observed the phenomenon, the circumstances surrounding it are such as to leave no doubt that it may be responsible for some forest fires.

The most accurate data on the causes of forest fires are from the records kept on the National Forests. A summary of these data is given in Table 1.

TABLE 1.—*Number of fires on the National Forests in 1906, 1907, 1908, 1909, 1910, and 1911, and reported causes; also percentage of causes to total number of fires.*

Causes.	1906		1907		1908		1909		1910		1911		Average per cent from 1906 to 1911, inclusive.
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	
Railroads	303	26.7	273	20.1	603	22.1	1,186	37.8	1,704	32.8	442	13.1	26.7
Lightning	261	23.0	176	13.0	555	20.3	294	9.4	724	14.0	948	28.1	17.5
Incendiary	24	2.1	19	1.4	102	3.7	97	3.1	302	5.8	225	6.7	4.5
Brush burning	15	1.3	34	2.5	68	2.5	181	5.8	307	5.8	199	5.9	4.8
Campers	312	27.5	361	26.7	493	18.1	431	13.7	688	13.2	574	17.0	16.9
Sawmills	.....	.....	65	4.8	5	.2	38	1.2	51	1.0	33	1.0	1.1
Unknown	196	17.3	367	27.1	263	9.7	758	24.1	1,184	22.8	743	22.1	20.7
Miscellaneous	22	2.1	60	4.4	639	23.4	153	4.9	241	4.6	205	6.1	7.8
Total	1,133	100.0	1,355	100.0	2,728	100.0	3,138	100.0	5,201	100.0	3,369	100.0	100.0

The number of fires on the National Forests from two of the causes enumerated in Table 1 may be compared with similar data for property fires reported by insurance companies. These are "Incendiary" and "Lightning."

TABLE 2.—*Property fires in the United States (including exposure fires).*

[Compiled from the Chronicle Fire Tables.]

Year.	Number of fires.	Caused by—				Year.	Number of fires.	Caused by—			
		Incendiary.		Lightning.				Incendiary.		Lightning.	
		Number.	Per cent.	Number.	Per cent.			Number.	Per cent.	Number.	Per cent.
1885	14,114	3,135	22.21	380	2.69	1894	52,266	4,119	7.88	851	1.63
1886	15,222	3,474	22.82	405	2.66	1895	53,961	3,523	6.53	836	1.55
1887	18,163	3,712	20.43	409	2.25	1896	61,133	4,474	7.32	1,736	2.84
1888	26,528	3,267	12.32	396	1.49	1897	74,740	6,330	8.47	1,547	2.07
1889	29,965	3,721	12.42	348	1.17	1898	94,062	6,894	7.33	3,480	3.70
1890	35,411	4,700	13.28	711	2.01	1899	105,342	6,741	6.40	2,759	2.62
1891	37,282	4,558	12.23	521	1.40	1900	109,092	6,949	6.37	3,436	3.15
1892	44,141	3,068	6.95	839	1.90	1901	111,736	6,637	5.94	3,061	2.74
1893	54,035	4,068	7.53	659	1.22	1902	103,715	5,562	5.45	3 007	2.90

It will be seen that there is a decrease in the percentage of incendiary fires from 22.21 per cent in 1885 to 5.45 per cent in 1902. If this decrease has continued it should by now approximate the average percentage of incendiary fires upon the National Forests, which,

for the years 1906 to 1911, inclusive, is 4.5 per cent. The percentage of fires on National Forests reported as incendiary is increasing. This is due, however, to a larger and more efficient patrol force and an awakened and helpful public sentiment, enabling the causes of fire to be better ascertained, rather than to any increase in incendiarism.

The average percentage of forest fires caused by lightning, 17.5 per cent, is six or seven times as great as property fires caused by lightning, in spite of the fact that more thunderstorms are reported in the East, where the larger amount of property is situated. All of the available information on the relation of lightning to forest fires is presented in Forest Service Bulletin 111, "Lightning in Relation to Forest Fires," by Fred G. Plummer.

CONTRIBUTORY FOREST CAUSES.

A number of conditions in the forest contribute either to the inception or to the spread of fires. Some of these are natural forest conditions, while others result from the acts of man.

All forest fires start as small fires. Three kinds are distinguished—surface fires, which spread over the surface of the forest floor, fed by litter and undergrowth; ground fires, which smolder or burn only in the ground, consuming duff and humus and often the roots of trees; and crown fires, which consume the entire forest cover. All crown fires start from ground or surface fires, except when lightning ignites the tops of trees. In order for fire to get into the tree crowns the foliage must be close to the ground, or else the litter and undergrowth must be very heavy and inflammable. Both of these conditions obtain in many types of forests, and naturally increase the fire hazard.

Artificial litter on the forest floor, such as slash, is even more dangerous than natural litter. The refuse from bad logging becomes exceedingly inflammable as it dries out, and since it usually includes a large portion of the trees cut, burns long and fiercely. The history of logging in the United States shows that cut-over areas are in most cases so severely burned as to make their natural restocking with young growth exceedingly problematical. When a fire, instead of sweeping rapidly over the ground, burns long because of the large amount of fuel, it not only destroys the humus and duff, but the intense heat changes the chemical composition of the top soil. Forest fires may burn over the same area several times. If the first conflagration kills the stand without consuming it, the area within a few years will be covered with a large amount of dry, inflammable litter. Moreover, there will in all probability be a dense growth of young trees, which, if conifers, will not only contribute fuel to the next fire, but perhaps render it so hot as to consume everything, leaving no chances for further reproduction from natural seeding.

Insect depredations and forest fires are interrelated. Insect-killed timber furnishes dry fuel for the flames, and the damage is thereby increased. A forest fire in an insect-infected area will effectually destroy great quantities of the insects, but, on the other hand, insects may advance over a burned area and kill fire-injured trees which otherwise might have recovered. Dr. Hopkins believes, however, "that injuries by fire are not as a rule an important factor in contributing to subsequent depredations by bark beetles."[1]

CONTRIBUTORY CLIMATIC CAUSES.

It needs no argument to prove that dry wood burns better than wet, nor that droughts, hot seasons, hot waves, and warm winds decrease the amount of moisture in a forest and thereby increase the fire hazard. Nevertheless, it is not true that every drought is coincident with great fires, nor is it strictly true that all great fires have followed hot seasons. Other factors, such as wind, topography, and the inflammability of the type of forest in which a fire occurs, bear upon the hazard. Moreover, its origin determines to some extent whether or not a fire will become a great conflagration. Lightning is usually accompanied by a downpour of rain; those who start a fire carelessly will usually make some attempt to extinguish it or give the alarm. Incendiaries, on the other hand, intend that the small fire which they start shall become a great fire, and are likely to take advantage of natural conditions. Thus climate must be considered with other variable factors as a contributory cause of fires.

Droughts are the most notable of the contributory climatic causes of forest fires. Although a single month of exceedingly dry and hot weather might bring a forest to a state of dryness which several months of the same weather would not practically increase, still the drought has an added menace in the fact that the probability of a serious fire starting is increased with the length of time a region is without rain.

The cause or causes of droughts are unknown. A planet like the earth presents seasons that necessarily might differ from year to year, because of its elliptical orbit and inclined axis, its high mountain barriers running in different directions, and its enveloping atmosphere of uneven density and transparency. While it would seem that these, taken singly or together, might well account for any phenomena of heat or cold, humidity or dryness, wind or calm, they have never been marshalled in explanation of the long-continued dryness known as drought.

[1] Hopkins, A. D., Some Insects Injurious to Forests, Bureau of Entomology, Bulletin No. 58, Pt. V, p. 68.

Years during which great droughts have occurred in the United States are as follows:

1662.....Middle States.
1688.....Middle States.
1694.....Middle States.
1730.....Middle States.
1763.....Middle States.
1764.....Middle States.
1773.....Middle States.
1791.....Middle States.
1854.....Middle States.
1856.....Iowa and Indiana.
1857.....Iowa and Missouri.
1860.....Middle States.
1863.....Middle States.
1864.....Middle States.
1870.....Ohio, Wisconsin, and Missouri.
1874.....Middle States.
1876.....Northeast United States.
1881.....East of Mississippi River.
1886.....North Central States.
1887.....North Central and Middle Atlantic States.
1894.....Valleys of the Mississippi and Missouri Rivers.
1895.....Lake Region and Atlantic Coast.
1910.....Up to the latter part of August there was a deficiency of precipitation in every district of the United States, and it was exceptionally dry in the Northwest, where the percentage of the normal was only 26. The region most affected was the area drained by the Columbia River.

Hot seasons are summers of unusually high temperature. A hot season may be coincident with a drought, if there is a lack of precipitation. Since air at higher temperatures can absorb a great amount of moisture, part of which is withdrawn from vegetation, it is evident that this will contribute to inflammability of the forest cover.

A hot season which would be a contributory cause of forest fires would not necessarily be one which gave very high temperature with intermittent periods of cold weather or rain. Rather it would be a continued spell of warm weather in which the temperature would be above the normal, though not so high as to cause instability of the atmosphere.[1] Data are not at hand for making this distinction over

[1] Hot strata at lower elevations bring about an unstable condition of the atmosphere. The average rate of decrease in temperature with increase in altitude for unstable air in the lower part of the atmosphere is about 1° for each 330 feet of height. If the lower strata are very much warmer than normal, there will result an overturning of the air strata. This may occur gently, or with such violence as to create a storm, and then there will be a precipitation if the warm air, with a high moisture content, ascends to a higher and cooler altitude. This is what actually occurs when moisture-laden strata, moving against a barrier of mountains, are deflected upward and cooled.

the long periods for which records of hot seasons are available. In the United States hot seasons for the last 60 years were as follows:

1853.....Eastern United States.
1854.....South Central States.
1872.....Eastern States.
1877.....Eastern, Middle, and Southern States.
1879.....Central and Northeastern States.
1881.....General for the United States.
1882.....Eastern States.
1900.....General for the United States.

The records for European countries extend over much greater periods of time, but it is not always easy to separate droughts from dry seasons. The following record will be interesting as showing some of the extremes of weather conditions:

1186.....Western Europe; a year without a winter; apple trees blossomed in January, fruited in February, harvested in May, and the vintage was ready in August.
1303–4.....France; several of the principal rivers went dry.
1705.....France.
1718.....General in Europe.
1719.....France; very low water in the Seine.
1773.....General in Europe.
1778.....Italy.
1793.....General in Europe. In France very low water in the Seine.
1800.....Western Europe. The forests of Haguenaw and part of the Black Forest were burned.
1811.....Northern Europe.
1822.....France.
1826.....Western Europe. Forests were burned in Sweden and Denmark.
1834.....France.
1836.....Russia, Denmark, France, and Spain.
1842.....France.
1851.....Western Europe.
1852.....General in Europe.
1858.....Western Europe.

Hot waves are periods of three or more consecutive days in which the temperature is much above normal. These are common phenomena, and because of their heat and dryness may contribute to the fire hazard. They are caused by temporary suspension of the eastward movement of the atmosphere. Air strata, both upper and lower, have a general movement from west to east, and such a cessation, though it presents no phenomena at the surface of the earth, is actually a serious disturbance in the atmosphere. Hot waves are usually followed by a thunderstorm, and if there is much lightning, without a great downpour of rain, the chances for the ignition of trees is increased.

Warm winds, or "foehn" as they are sometimes known collectively, differ from the very local winds which come from a desert or other

heated area and make their influence felt over the adjoining country. Such are the hot winds known as the "Santa Ana" of southern California, the "sonora" of the Southwestern States, the hot winds of Texas or Kansas, and the so-called "northers" [1] of northern California, which, like the "sirocco" of Italy, may be both warm and damp.

The winds termed "foehn" appear to defy a law of physics, blowing from high altitudes to lower regions. These winds are warm, almost hot, and usually dry, in spite of the fact that they descend from cold or snow-covered slopes. The "foehn" [2] has been identified even in the Arctic regions, and is not uncommon in Iceland and Greenland. On one occasion a foehn in western Greenland lasted for nine days during November and December. In this country the best example of the foehn is the "chinook," [3] which is common in the Northwestern States, eastward as far as the Black Hills, sometimes into Colorado, northward into British Columbia, and sometimes into Alaska. Often it is welcomed as an agreeable change of weather, but sometimes it brings disaster in the swollen streams from quickly melted snow.

The foehn are a great menace to forests as a contributory cause of fires, not only because they may be hot and dry, but also because they are strong winds and may fan a flame into a terrible conflagration. Such winds increase the length of the fire season in localities where they occur. Ordinarily the fire hazard becomes very small with the advent of winter, attended by snow, rain, and decreased evaporation, but a foehn, such as the "chinook," is likely to occur at any season of the year, and its effect can not be disregarded.

SMOKE PHENOMENA OF FOREST FIRES.

It has already been pointed out that the damage resulting from forest fires is usually estimated in acres, quantity of timber, or in dollars, that these estimates are always too low, and that they do not include other losses due to the interruption of business, destruction of young growth, loss of soil fertility, and damage to watercourses, with the attendant depreciation of property. Even this is not all.

A thrifty forest purifies the air we breathe, and it is an irony of nature that when it goes up in smoke it causes a pollution of the

[1] This "norther" should not be confounded with the "northers" from Montana to the Gulf of Mexico, which are cold.

[2] Foehn in different countries differ slightly in characteristics, but they are all related. The word was originally applied to the warm winds which descended from the Alps in Switzerland. Local names are given in other countries; as the solano and leveche of Spain; the leste of Madeira Islands; the totenturmwind in Hungary; the harmattan in northwestern Africa; the simoom in northeastern Africa; the khamsin in Egypt; the zonda in Argentina; and the brickfielder in New South Wales.

[3] For a discussion of the chinook as a foehn see Descriptive Meteorology, by Willis L. Moore, 1910, p. 186.

atmosphere. The mischief thus caused is by no means trivial, since a heavy pall of smoke interrupts business, interferes with navigation, and, turning night into day, compels the use of artificial light. Such conditions have obtained over an expanse of many thousands of miles, and the actual loss must be very great. In the vicinity of a great fire the atmosphere sometimes carries ashes and burning brands to a distance of several miles. The atmosphere in motion, flowing over the surface of the earth, has an enormous carrying capacity, very much greater than is generally supposed. It is analogous to flowing water in that matter can be carried to any distance, determined only by the sustained velocity of the wind and the size or weight of the particles of matter. Wind, like water, will deposit the particles "downstream," assorting them and carrying the lightest the greatest distance. It is probable that, for equal areas, the winds transport as much matter as the streams.

Forest fires are the most frequent causes of widespread pollution of the atmosphere, and the volume of the pollution is exceeded only in the case of violent volcanic eruptions. The forest fire not only causes an uprush of heated air, usually with a cyclonic movement, but it furnishes at the same time the material which is lifted to the higher atmospheric strata. Under such conditions it is not surprising that fires may jump several miles; in fact, as far as a live brand can be carried. The phenomena are analogous to those of local winds, which, sometimes assuming cyclonic form, can suck up water, sand, dust, and all kinds of small objects, which later "rain" down. The forms of wind which raise heavy matter are such centers of cyclonic action as whirlwinds, sand spouts, and waterspouts. These are the causes of many of the so-called prodigies, which have as surely been observed as they have reluctantly been believed. The shower of oranges which occurred near Naples in 1833 would have been discredited had it not been known that the fruit had been taken up by just such means. The waterspout is guilty, in a similar manner, of causing showers of living frogs, turtles, fish, and worms, and the sand spout or dust storm may fill the air with particles which must eventually fall.

A large forest fire has an appreciable effect upon the surrounding atmosphere, causing a movement of the air toward the fire. This effect is quite local, and is overbalanced if there is a strong wind blowing, which will drive the fire before it. Under such conditions a fire may advance with great rapidity, while blazing branches sail through the air and start other fires far ahead of the main conflagration. During the great forest and city fire at Fernie, British Columbia, August 1–8, 1908, which was accompanied by a high wind, flaming trees, timbers, lumber, and sections of buildings were carried.

This fire burned a strip 3 miles wide for a distance of about 20 miles. During the great Idaho fire of August 20–22, 1910, the same phenomena were observed. At some points the fire was actually blown out by the wind. In one case, while crossing a depression, the fire was lifted and carried ahead, leaving a belt of unburned forest three-fourths of a mile wide.

The tendency is for smoke to spread out and to be dissipated, but if the volume is great it may be identified for hundreds of miles, even when the cause of it is unknown. At greater distances, where the smoke is more attenuated, there is only a slight obscuration of light, though if the smoke has descended to the earth it may interfere with vision. At still greater distances from the fire, when the smoke has been further mixed with clear air, its presence can only be noted by a yellow or pearly haze about the horizon or by the discoloration of rain. These phenomena, observed from time immemorial, have been known by various names—in this country as dark days, dry fogs, Indian summers, and colored rains.

FIG. 1.—Phenomena caused by smoke from a forest fire.

Dark days have been recorded for centuries. Usually there is a gradually increasing gloom until it becomes so dark that artificial light is necessary. This darkness may last a few hours or several days and decrease as gradually as it came.

We are now able to show that dark days are due to dense smoke in the atmosphere, and that in this country forest and prairie fires have been the causes. In other countries peat fires and volcanic eruptions have also furnished smoke to produce dark days, but such cases are more rare. Theories advanced in olden times that dark days are caused by solar eclipses or by the transit of inferior planets across the solar disk are ridiculous, since a total solar eclipse seldom lasts over five minutes, and a transit of Venus, the largest and nearest of the inferior planets, is barely visible to the naked eye, and would not cause a diminution in light or heat that could be measured. If any consideration of such theories were necessary, it would be sufficient to point out that the dark days of modern history have not been coincident either with eclipses or transits.

The record for dark days in the United States and Canada is as follows:[1]

1706.....May 12, 10 a. m., New England.
1716.....October 21, 11 a. m. to 11.30 a. m., New England.
1732.....August 9, New England.
1762.....October 19, Detroit.
1780.....May 19, New England. (Black Friday. The Dark Day.)
1785.....October 16, Canada.
1814.....July 3, New England to Newfoundland.
1819.....November 6–10, New England and Canada.
1836.....July 8, New England.
1863.....October 16, Canada. ("Brief duration.")
1868.....September 15–October 20, western Oregon and Washington.
1881.....September 6, New England. (The Yellow Day.)
1887.....November 19, Ohio River Valley. ("Smoky Day.")
1894.....September 2, New England.
1902.....September 12, western Washington.
1903.....June 5, Saratoga, N. Y.
1904.....December 2, 10 a. m., for 15 minutes, Memphis, Tenn.
1910.....August 20–25, northern United States, from Idaho and northern Utah eastward to St. Lawrence River.

Most dark days might more properly be called "yellow days."[2] Even "Black Friday," May 19, 1780, which was the most memorable of all the dark days of modern times, was preceded by a gradually increasing yellowness and an odor. The same was true of the dark days of 1819, 1881, 1894, and 1903. September 6, 1881, was so distinctly yellow that it is known as "The Yellow Day."

The evidence that dark days result from fires may be briefed as follows: In 1716 the air was very full of smoke. During the dark day of 1780 ashes of burnt leaves, soot, and cinders fell in some sections from forest fires in New York and Canada. In 1785 black rain fell during a thunder shower in the darkened area. In 1814 ashes of burnt wood fell and there was a strong smell of smoke. In 1819 a shower in the darkened area was discolored as if the water were impregnated with soot. The fires near Wissitaquik, Me., probably caused the darkness in 1836.[3] In 1868 the smoke from the Coos and St. Helens fires was encountered on the Pacific Ocean. In 1881 dense smoke was noticed over a large area (fig. 2), chiefly from the Michigan forest fires. In 1887 the smoke from forest fires to the westward interfered with navigation, became painful to the eyes, and rendered breathing disagreeable. In 1894 the smoke came chiefly from the Hinckley fire in Minnesota. In 1902 the smoke came from numerous

[1] Notable dark days elsewhere occurred in Mediterrania B. C. 295, 44, A. D. 252, 746, 775, 1090, 1106, 1208, 1547; in England, January, 1807, May, 10, 1812, Dec. 27–29, 1813, Nov. 27, 1816; at Victoria, Australia (Black Thursday), Feb. 6, 1851. The long and widespread darkness of June, 1783, reported from Europe, Asia, Africa, and North America, was probably due to volcanic eruptions.

[2] A yellow tinge in the atmosphere is an indication of smoke from forest fires. A red glow sometimes indicates dust from volcanoes.

[3] "Black Thursday" in Victoria, Australia, in 1851 was caused by terrible brush fires at the time.

fires, one of the largest being in the South Fork of Lewis River watershed. In 1903 the smoke was from fires in the Adirondacks. In 1910 the smoke was from the great Idaho fires. The area in which artificial light was used in daytime is shown in figure 3, but the area in which smoke was observed was very much greater. Indeed, the British ship *Dunfermline* reported that on the Pacific Ocean, 500 miles west of San Francisco, the smell of smoke was noticed, and the haze prevented observations for about 10 days. In connection with the 1910 phenomenon it was noted that a cool wave followed, passing eastwardly over the same area, but spreading farther southward,

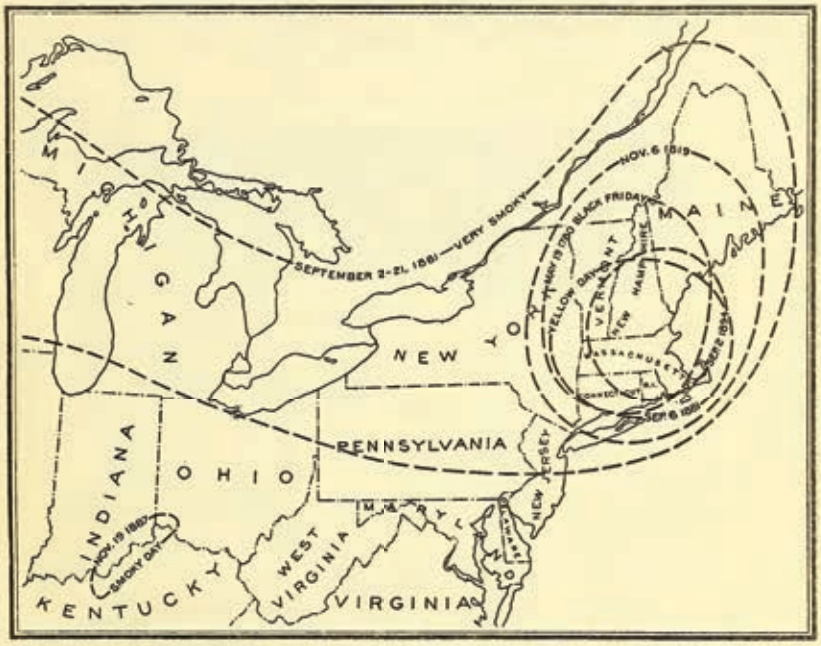

FIG. 2.—Areas in the northeastern States in which occurred the most important dark days since 1780.

which gave the lowest temperatures, with frosts, for the month of August.

New England easily leads in the phenomena of very dark days, and several of the most pronounced have affected practically the same area which is shown in figure 2. The tracks of many air currents and storm centers converge toward this area from all over the United States, and sometimes meet an opposing storm from the east or northeast. It therefore seems that dark days are caused by the banking up of smoke-laden air. The greatest forest fires have occurred in the Northern States, and the winds, transporting the smoke eastward, flow over the New England States. At such a time, if a "nor'easter"

flows in from the ocean and banks up a smoke-laden stratum, increasing its thickness and density, it is evident that obscurity, and perhaps darkness, will result.

Dry fogs.—On portions of the Pacific coast, particularly in the Puget Sound country, the smoke from forest fires is often so dense as to interfere with navigation. The same is true on the Great Lakes and on navigable rivers. Under such circumstances captains prefer to run slow or tie up until the danger has passed. At the time of the Hinckley fire, in 1894, it was estimated that the losses to lake vessels on account of the smoke exceeded $40,000.

The smoke may last for days or weeks, until dispersed by a favorable wind. When there is no odor, it might be taken for fog, except

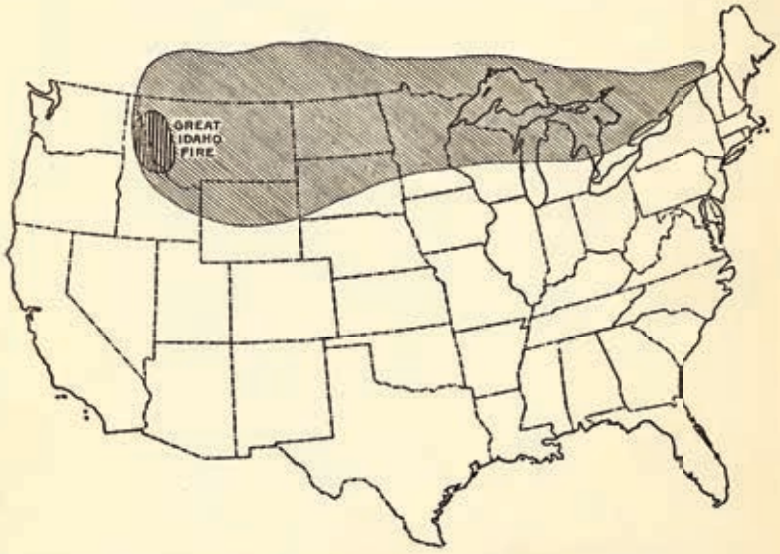

FIG. 3.—Area in which dark days occurred, caused by smoke from the great Idaho fire, August 19–25, 1910.

that it is dry. Although it is simply "smoke," the phenomenon is also called "dry fog" in English-speaking countries. In Spain it is known as "callina"; in Germany as "hohrauch"; in Switzerland as "hale"; and in Russia as "mgla." Prairie fires and the burning of peat or turf beds produce the same phenomena.

Several of such dry fogs have been noted in history. In 1783 the phenomenon lasted from May 9 until the latter part of June. It was first observed at Copenhagen and extended over France, Germany, and the Alps. At the same time a similar phenomenon existed over a large part of North America. On several of the days the sun was so obscured that they were recorded as "dark days." In 1831 a dry fog extended generally over the Northern

Hemisphere. In May and July, 1834, there was a dry fog in central Europe, caused by the burning of peat beds in Germany and forest fires near Berlin and in Sweden and Russia. In 1881, in the northeastern United States, a dry fog lasted from September 1 to September 10, culminating on September 6 in the "yellow day." Its limits were determined as between 40 and 45 degrees of latitude, and between 67 and 87 longitude. (See fig. 2.) This was caused by forest fires in Michigan, with contributions from fires in New Jersey, Pennsylvania, and Canada.

Indian summer is the name applied to periods during the months of October and November when the weather is unseasonably warm and there is a dry fog [1] of longer duration but of less intensity than the average. The air during Indian summer is saturated with impurities so fine that they are not precipitated unless a rain occurs. It is characterized by a smoky haze, sometimes of pearly or phosphorescent appearance, so attenuated that the zenith may be very blue, though the smoky appearance is very pronounced near the horizon.

Under different names Indian summer is recognized all over the world. In England it is called "St. Luke's summer" when it occurs in October, and "St. Martin's summer" if in November; in Wales, "St. Michael's summer"; in France, the "summer of St. Martin" and the "summer of St. Denis"; in Italy, the "summer of Santa Teresa"; in Sweden, "St. Bridget's summer"; in Russia and Germany, "old woman's summer"; in Argentina, "St. John's summer."

The phenomena vary in intensity in different years, or may be wholly lacking in some locality. On an average of one year in three Indian summer is marked, and about one year in three it is wholly lacking.

Colored rains, being so little known and understood, are considered as prodigies; nevertheless, they have been observed for many centuries. The phenomena are not difficult to understand. We say that "a shower of rain has cleared the atmosphere," meaning that the drops of water have carried to the earth such impurities as were held in suspension or solution. It is to be expected that under certain conditions, depending upon the quantity and nature of these impurities, the falling rain should be colored, and that in some cases the color should be so marked as to attract attention. Forest fires, as has been shown, are one of the principal agents by which the atmosphere is polluted, and are therefore related to the phenomena of colored rains. Usually such rains, noted in the daily press, are better described as discolored, being gray or muddy. It is not probable,

[1] American Weather, Gen. A. W. Greeley, 1888, p. 245.

however, that the most notable or highly colored rains mentioned in history can be attributed to smoke.[1]

HISTORIC FIRES.

As a calamity a great forest fire ranks well with flood, pestilence, famine, or earthquake and, like them, is as soon forgotten. Some

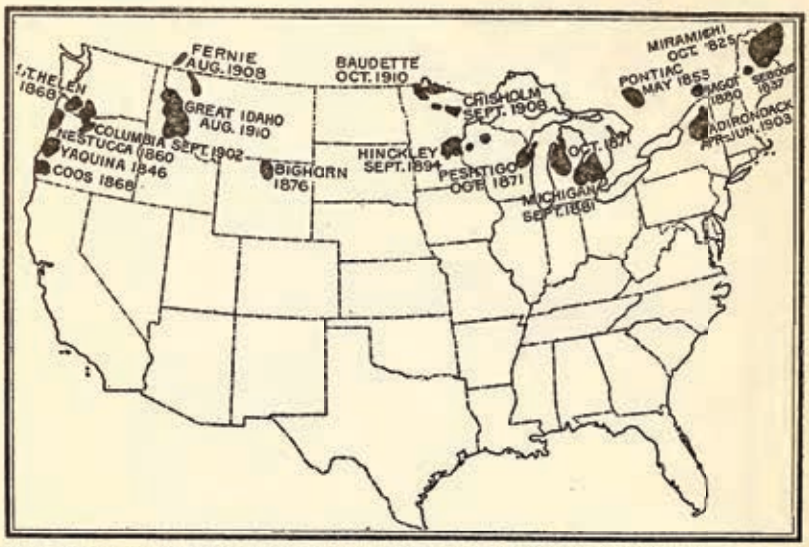

FIG. 4.—Diagram showing the location of the greatest forest fires in the United States since the year 1800.

fires, however, because of lives lost, property destroyed, or large areas burned, have become historic.

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[1] Oct. 16, 1785, a black rain fell in Canada, and on Nov. 6, 1819, black rain and snow fell in the northern part of the United States and Canada. In the Middle Atlantic States, Apr. 11–13, 1902, there were showers of eolian dust, which, when accompanied by rain, fell as gray mud. Similar dust fell at Grantville, Pa., Feb. 10, 1896. On Apr. 12, 1902, a rain in the Middle Atlantic States was so loaded with dust from the dry western plains as to cause a mud shower.

Truly remarkable instances are: "Showers of milk or white rain" in Italy in the years 620, 629, and 643; yellow rains, May 16, 1646, at Copenhagen; May 19, 1665, Norway; Aug. 24, 1764, at Heidelberg, Germany. The causes of yellow rains have been assigned not only to dust, but to volcanic smoke and to the pollen of plants. A yellow rain in Italy, May 13, 1907, was attributed to Stromboli and Etna, but similar showers in the vicinity of Naples have been caused by pollen.

An exceptional occurrence of red rain was observed off the coast of Newfoundland in February, 1890.

In Europe red rains have been so numerous in history that several hundred have been catalogued. They are associated with the sirocco, a strong wind which carries dust from the desert regions of northern Africa over all of southern Europe and sometimes as far north as Russia.

During the last century notable red rains occurred:

1803—February.....	Italy.
1813—March 14.....	Calabria.
1814—October.....	Oneglia, between Nice and Genoa.
1819—September....	Studein, Moravia.
1821—May.....	Giessen.
1839—April.....	Philippeville, Algeria.
1841—February.....	Genoa, Parma, Canigon.
1842—March.....	Greece.
1846—May.....	Siam, Chambery.
1846—October.....	Danphine, Savoy, Vivamis.
1847—March.....	Chambery.
1852—March.....	Lyons.
1854—May.....	Horbourg, near Colmar.
1860—December 31...	Sienna.
1862—March.....	Beaunan, near Lyons.
1863—March.....	Rhodes.
1863—April.....	Between Lyors and Aragon.
1868—April 26.....	Toulouse.
1869—March 10.....	Naples.
1869—March 23.....	Sicily.
1870—February 13...	Rome.
1890—May 15.....	Oppide Mamertina, Italy.

Snow will also precipitate dust particles, which doubtless act as nuclei in the formation of snow crystals.

The first accounts of such great events are generally exaggerated and subsequent accounts are often conflicting. The best sources of information have been given preference in Table 3.

TABLE 3.—*Historic forest fires in the United States and Canada.*

Date.	Name of fire.	Location.	Area burned.	Lives lost.
			Acres.	*Number.*
1825—October	Miramichi	Maine and New Brunswick	3,000,000	160
1837—(?)	Seboois	Maine	120,000	.....
1846—(?)	Yaquina	Oregon	450,000	.....
1853—May	Pontiac	Quebec	1,600,000	.....
1860—(?)	Nestucca	Oregon	320,000	.....
1868—September	Coos	do	300,000	.....
1868—September	St. Helen	Washington and Oregon	300,000	.....
1871—October	Peshtigo	Wisconsin	1,280,000	1,500
1871—October	.....	Michigan	2,000,000	.....
1876—(?)	Big Horn	Wyoming	500,000	.....
1880—September	Bagot	Quebec	288,000	.....
1881—September	Michigan	Michigan	1,000,000	138
1891—May	Comstock	Wisconsin	64,000	.....
1894—July	Phillips	do	160,000	13
1894—September	Hinckley	Minnesota	160,000	418
1902—September	Columbia	Oregon and Washington	604,000	18
1903—April-June	Adirondack	New York	450,000	.....
1908—August	Fernie	British Columbia	64,000	9
1908—September	Chisholm	Minnesota	20,000	.....
1910—August	Great Idaho	Idaho and Montana	2,000,000	85
1910—October	Baudette	Minnesota and Ontario	300,000	42

STATISTICS OF DAMAGE AND LOSS.

Table 4 is a compilation of such data as can be expressed either in number of fires, area burned, thousands of board feet damaged, or the money value of the forest or forest products damaged. This last item sometimes includes the value of buildings, crops, or stock, though in the majority of cases it is not possible to segregate the amounts.

Many of the data in regard to fires collected by the Forest Service were found useless in the compilation of this table. A report that "a fire destroyed the crops and some stock belonging to Peter Swan and then spread into the adjoining woods where it did an immense amount of damage" has no value for the present purpose, except to prove that the statistical record is an underestimate of the damage done by forest fires, since it can not include these vague items.

In some cases the record seems complete, as indicated by the number of fires, their causes, etc.; in others it is clearly incomplete, since it shows the damage resulting from only one or a very few fires. Conclusions should not be drawn by interpolating from fragmentary data on the basis of complete data, since the causes and contributory causes are extremely variable for different years. Thus, although the forest fires reported in the census for 1880 are assumed to be a complete record for that year, they would not, in the case of a given State, serve as a basis upon which to estimate the number or extent of fires for any other year.

More data are needed before an estimate can be made of the probable fire hazard in each State under normal climatic conditions, since the States are of unequal size, with different amounts of forested land, and with forests of widely different types.

Figures do not convey an adequate expression of the prevalence of forest fires, nor can any general map do the subject full justice.

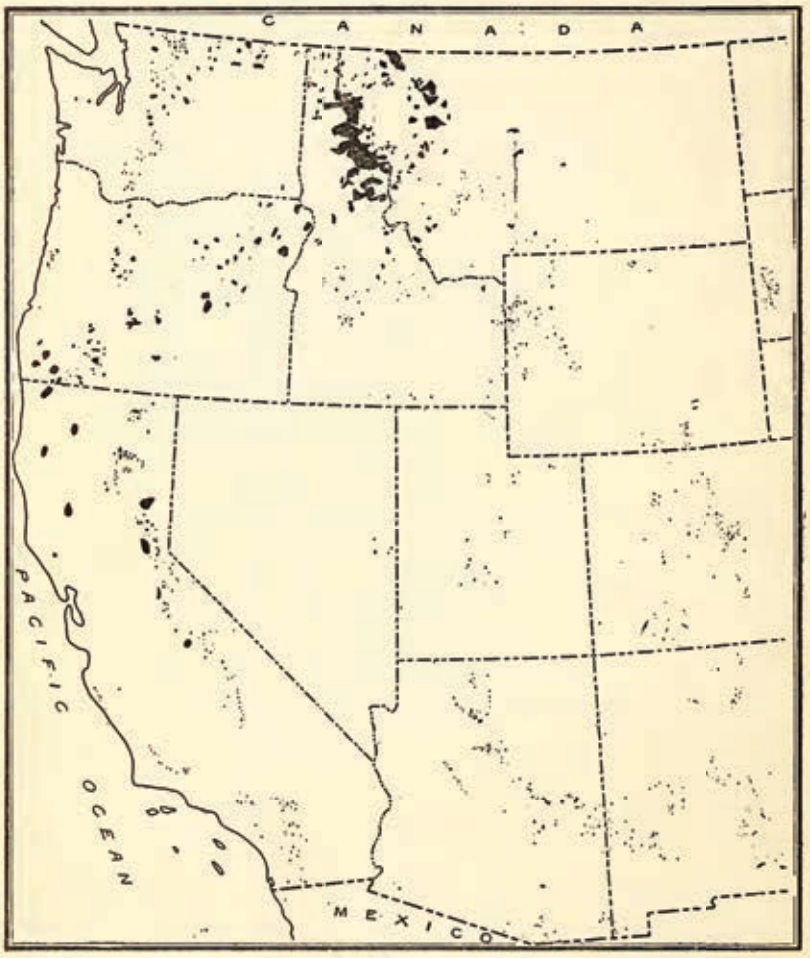

FIG. 5.—Fires of 1910 in the western United States.

Figure 5 shows the fires of 1910 only upon the National Forests in the western United States, but it is not possible to show upon it the locations of fires which occurred on private lands outside of the National Forests. In the State of Washington, for instance, there were 4,410 such fires, and a graphic record of them, on the scale used, would be impossible. Figure 6 shows, upon a larger scale,

the location of fires during 1910 in the timbered areas of Minnesota and Wisconsin and illustrates graphically what the statistics fail to convey.

While statistics are not sufficiently complete to justify a positive statement of the actual depletion of our forest resources through fire, they are more than sufficient to prove that this loss is appalling. In round figures the land area of the United States is 1,900 million acres, of which only about two-fifths is forested. Three-fourths

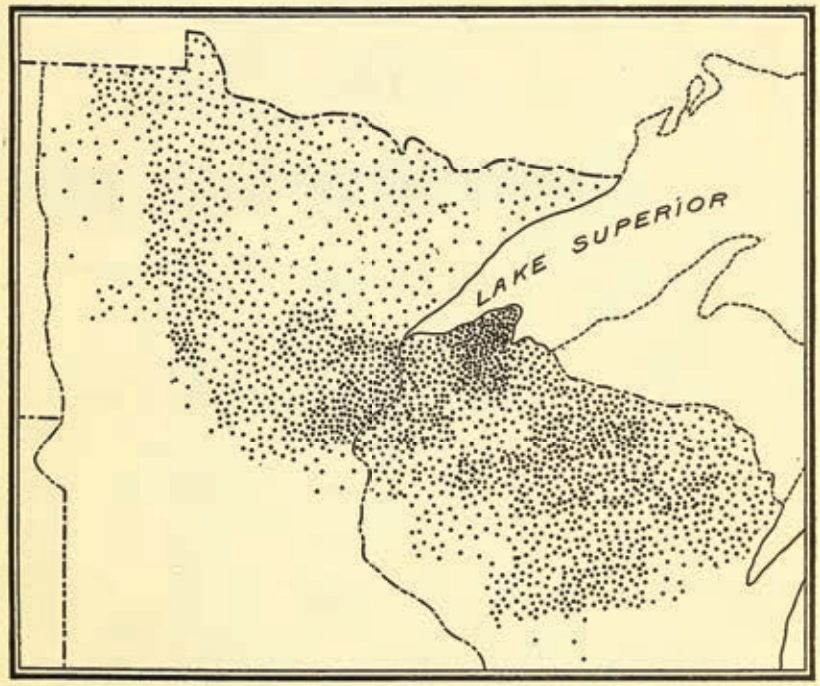

FIG. 6.—Location of fires of 1910 in northern Minnesota and Wisconsin.

of the original stand has been culled or cut and the present rate of destruction is three times that of the growth. At present the stand is about 2,800 billion board feet.[1] The annual cut is about 100 billion board feet, and the loss from fire, covering 10 million acres, varies according to whether the greater areas are virgin forest, cut lands, or reburns. We are prodigal of our heritage, both principal and interest. We cut each year 3½ per cent of the stand, and burn almost all, if not all, of the growth.

[1] Forest Service Circulars 166 (1909) and 171 (1909) gave 2,500 billion board feet as the estimate. The Summary of the Report of the Commissioner of Corporations on the Lumber Industry, Part I, Standing Timber (1911), page 14, gives 2,800 billion feet.

TABLE 4.—*Forest fires in the United States, Canada, and Newfoundland.*

State.	Year.	Number of fires caused by—								Total fires.	Area burned.	Damage.		Remarks.
		Railroads.	Lightning.	Incendiary.	Brush burning.	Campers.	Sawmills.	Unknown.	Miscellaneous.			Amount.	Value.	
										Number	*Acres.*	*M. B. F.*		
Alabama	1880	4	.....	.....	50	23	.....	.....	.....	77	569,160	.....	$121,225	Tenth Census record.
Arizona	1875	.....	.....	1	.....	.....	.....	.....	.....	1	10,000	.....	.....	Fragmentary record.
	1880	.....	.....	2	.....	5	.....	.....	.....	7	10,240	.....	56,000	Tenth Census record.
	1886	.....	1	.....	.....	.....	.....	.....	.....	1	5,000	20,000	.....	Fragmentary record.
	1900	.....	.....	.....	.....	.....	.....	2	.....	2	10,000	.....	.....	Do.
	1901	.....	.....	.....	.....	.....	.....	.....	.....	350	35,807	.....	.....	National Forest only.
	1902	.....	.....	.....	.....	.....	.....	.....	.....	294	42,841	.....	.....	Do.
	1903	.....	.....	.....	.....	.....	.....	.....	.....	191	3,120	.....	.....	Do.
	1907	71	37	.....	1	14	.....	13	3	139	13,618	1,771	1,995	Do.
	1908	49	38	1	.....	21	1	24	8	142	14,624	2,459	2,481	Do.
	1909	9	23	.....	.....	20	6	68	7	133	45,257	3,899	9,106	Do.
	1910	13	51	1	2	21	.....	69	28	185	126,299	20,154	21,130	Do.
	1911	5	76	1	2	44	1	32	9	170	57,470	146	15,520	Do.
Arkansas	1880	.....	1	.....	27	20	.....	.....	.....	48	858,115	.....	259,470	Tenth Census record.
	1908	68	.....	18	4	14	.....	1	.....	105	57,310	10,278	20,648	National Forest only.
	1909	131	3	40	7	21	3	183	3	391	54,146	4,378	44,631	Do.
	1910	8	2	161	13	21	1	207	2	415	501,292	23,479	38,502	Do.
	1911	4	.....	50	12	10	.....	101	8	185	142,717	2,581	45,389	Do.
California	1860	.....	.....	.....	.....	.....	.....	1	.....	1	.....	.....	10,000	Fragmentary record.
	1871	.....	.....	.....	.....	.....	.....	1	.....	1	23,000	.....	.....	Do.
	1877	.....	.....	.....	.....	.....	.....	1	.....	1	7,000	.....	.....	Do.
	1879	.....	.....	.....	.....	1	.....	1	.....	2	37,000	.....	.....	Do.
	1880	.....	.....	5	9	55	.....	.....	.....	69	356,895	.....	440,750	Tenth Census record.
	1881	.....	.....	1	.....	1	.....	1	.....	3	70,000	.....	.....	Fragmentary record.
	1884	.....	.....	.....	.....	.....	.....	2	.....	2	16,000	.....	.....	Do.
	1885	.....	.....	.....	.....	.....	.....	1	.....	1	150,000	.....	.....	Do.
	1886	.....	.....	.....	.....	.....	.....	1	.....	1	.....	4	3,000	Do.
	1887	.....	.....	.....	2	.....	.....	6	.....	8	109,200	.....	.....	Do.
	1888	.....	.....	.....	.....	1	.....	4	.....	5	.....	.....	42,500	Do.
	1889	.....	.....	.....	.....	1	.....	5	.....	6	.....	.....	319,000	Do.
	1890	.....	.....	.....	.....	.....	.....	7	.....	7	33,000	.....	.....	Do.
	1891	.....	.....	.....	1	1	.....	3	.....	5	402,000	.....	.....	Do.
	1892	.....	.....	.....	.....	2	.....	5	.....	7	12,300	.....	.....	Do.
	1893	.....	.....	.....	.....	1	.....	4	.....	5	115,100	.....	.....	Do.
	1894	.....	.....	.....	.....	.....	.....	1	.....	1	.....	.....	4,000	Do.
	1895	.....	.....	.....	.....	.....	.....	8	.....	8	67,300	.....	.....	Do.

	1896	.....	.....	.....	.....	.....	.....	1	.....	1	1,000	.....	12,000	Do.
	1897	1	.....	.....	.....	.....	.....	7	.....	8	56,000	.....	.....	Do.
	1898	.....	.....	.....	.....	1	.....	2	.....	3	20,000	.....	.....	Do.
	1899	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	No record.
	1900	.....	.....	.....	.....	.....	.....	2	.....	2	6,500	.....	.....	Fragmentary record.
	1901	.....	.....	.....	.....	.....	.....	.....	.....	242	18,524	.....	.....	National Forest only.
	1902	.....	.....	.....	.....	.....	.....	.....	.....	243	7,895	.....	.....	Do.
	1902	.....	.....	1	.....	.....	.....	.....	.....	1	15,000	21,000	75,000	Fragmentary record.
	1903	.....	.....	.....	.....	.....	.....	.....	.....	167	13,246	.....	.....	National Forest only.
	1904	.....	.....	.....	.....	1	.....	.....	.....	1	600	12,000	18,000	Fragmentary record.
	1905	.....	.....	1	.....	.....	.....	1	.....	2	.....	.....	230,500	Do.
	1906	20	10	5	12	12	.....	.....	61	120	650,000	.....	.....	
	1907	24	42	.....	4	69	.....	129	37	305	75,060	4,107	8,601	National Forest only.
	1908	12	165	18	17	119	.....	124	117	572	163,216	51,902	103,259	Do.
	1908	.....	.....	.....	.....	.....	.....	.....	.....	1,096	505,416	170,482	478,259	
	1909	64	79	39	45	150	.....	250	11	638	357,269	40,000	600,000	
	1910	11	110	59	29	63	11	204	66	553	367,344	209,946	407,569	Do.
	1910	.....	.....	.....	.....	.....	.....	.....	.....	.....	482,563	.....	.....	
	1911	24	282	92	38	71	15	195	80	797	66,508	4,328	51,083	Do.
Colorado	1868	.....	.....	.....	.....	.....	.....	1	.....	1	5,760	2,500	.....	Fragmentary record.
	1877	.....	.....	.....	.....	1	.....	.....	.....	1	6,000	.....	.....	Do.
	1879	.....	.....	.....	.....	1	.....	.....	.....	1	125,000	.....	.....	Do.
	1880	.....	.....	1	.....	26	.....	.....	.....	27	113,820	.....	935,500	Tenth Census record.
	1884	.....	.....	1	.....	.....	.....	.....	.....	1	2,500	12,500	.....	Fragmentary record.
	1888	.....	.....	1	.....	.....	.....	.....	.....	1	1,000	8,000	60,000	Do.
	1890	.....	.....	.....	.....	.....	.....	2	.....	2	3,500	.....	10,000	Do.
	1892	.....	.....	.....	.....	4	.....	.....	.....	4	40,000	.....	.....	Do.
	1893	.....	.....	.....	.....	3	.....	2	.....	5	14,500	.....	.....	Do.
	1894	1	.....	.....	.....	.....	.....	.....	.....	1	3,000	3,000	7,000	Do.
	1895	.....	.....	.....	.....	.....	.....	1	.....	1	2,000	.....	.....	Do.
	1898	.....	.....	.....	.....	1	.....	.....	.....	1	300	.....	.....	Do.
	1900	.....	.....	.....	.....	2	.....	1	.....	3	7,800	.....	.....	Do.
	1901	10	7	1	.....	120	.....	2	.....	140	1,690	.....	5,375	
	1901	.....	.....	.....	.....	.....	.....	.....	.....	220	10,327	.....	.....	National Forest only.
	1902	.....	.....	.....	.....	.....	.....	.....	.....	168	1,895	.....	.....	Do.
	1902	.....	.....	.....	.....	.....	.....	1	.....	1	13,500	.....	93,660	Fragmentary record.
	1903	.....	.....	.....	.....	.....	.....	.....	.....	39	4,776	.....	.....	National Forest only.
	1904	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	No record.
	1905	.....	.....	.....	1	.....	.....	.....	.....	1	3,200	6,000	6,000	Fragmentary record.
	1906	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	No record.
	1907	20	3	.....	2	21	.....	87	1	134	1,368	109	225	National Forest only.
	1908	104	10	.....	4	40	2	132	9	301	3,919	4,995	11,795	Do.
	1909	69	10	2	9	17	3	12	6	128	662	223	1,260	Do.
	1910	246	36	2	8	45	2	38	10	387	4,260	5,209	7,547	Do.
	1911	42	19	1	15	31	.....	12	10	130	190	179	566	Do.
Connecticut	1860–	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
	1904	.....	.....	2	1	1	.....	13	.....	17	17,050	30,000	101,000	Fragmentary record.
	1905	.....	.....	.....	.....	.....	.....	.....	.....	.....	8,000	.....	.....	
	1906	.....	.....	.....	.....	.....	.....	.....	.....	123	4,036	.....	.....	
	1907	.....	.....	.....	.....	.....	.....	.....	.....	109	4,387	.....	.....	
	1908	.....	.....	.....	.....	.....	.....	.....	.....	283	18,430	.....	.....	
	1909	95	.....	.....	84	.....	.....	160	.....	339	14,779	.....	15,721	
	1910	248	.....	15	72	.....	.....	415	84	834	47,443	.....	.....	

TABLE 4.—*Forest fires in the United States, Canada, and Newfoundland*—Continued.

State.	Year.	Number of fires caused by—								Total fires.	Area burned.	Damage.		Remarks.
		Railroads.	Lightning.	Incendiary.	Brush burning.	Campers.	Sawmills.	Unknown.	Miscellaneous.			Amount.	Value.	
										Number	*Acres.*	*M. B. F.*		
Delaware	1880	6	.....	2	6	.....	.....	.....	.....	14	3,305	.....	$15,675	Tenth Census record.
Florida	1880	.....	.....	3	13	2	.....	.....	.....	18	105,320	.....	69,900	Do.
	1910	.....	1	7	10	4	.....	6	.....	28	10,000	1,000	500	National Forest only.
	1911	.....	.....	5	.....	1	.....	27	.....	33	76,760	.....	7,701	Do.
Georgia	1880	2	.....	.....	36	16	.....	.....	.....	54	705,351	.....	167,620	Tenth Census record.
Idaho	1878	.....	.....	1	.....	.....	.....	.....	.....	1	46,000	250,000	500,000	Fragmentary record.
	1880	.....	2	.....	.....	19	.....	.....	.....	21	21,000	.....	202,000	Tenth Census record.
	1883	.....	.....	.....	.....	.....	1	.....	.....	1	3,000	4,000	4,000	Fragmentary record.
	1884	.....	.....	.....	.....	1	.....	.....	.....	1	58,000	400,000	800,000	Do.
	1888	.....	.....	1	.....	.....	.....	.....	.....	1	13,000	200,000	.....	Do.
	1889	.....	.....	1	.....	1	.....	.....	.....	2	27,500	.....	.....	Do.
	1890	.....	.....	.....	.....	.....	.....	1	.....	1	10,000	.....	.....	Do.
	1893	.....	.....	.....	.....	.....	.....	.....	1	1	13,000	50,000	50,000	Do.
	1895	.....	.....	.....	.....	.....	.....	1	.....	1	7,000	40,000	80,000	Do.
	1899	.....	.....	.....	.....	1	.....	.....	.....	1	5,000	10,000	20,000	Do.
	1900	.....	.....	1	.....	.....	.....	.....	.....	1	2,000	10,000	30,000	Do.
	1901	.....	.....	.....	.....	.....	.....	.....	.....	177	3,301	.....	.....	National Forest only.
	1902	.....	.....	.....	.....	.....	.....	.....	.....	91	5,233	.....	.....	Do.
	1902	.....	.....	.....	.....	.....	.....	1	.....	1	16,000	.....	1,000,000	Fragmentary record.
	1903	.....	.....	.....	.....	.....	.....	.....	.....	26	330	.....	.....	
	1907	1	25	2	10	114	.....	21	3	176	4,629	3,712	6,638	National Forest only.
	1908	10	106	6	17	66	.....	133	2	340	39,576	69,859	158,300	Do.
	1909	.....	.....	.....	.....	.....	.....	.....	.....	1,232	24,665	46,110	79,982	
	1910	189	162	16	76	90	7	161	43	744	1,761,106	4,021,196	11,399,651	
Illinois	1877	.....	.....	.....	.....	.....	.....	1	.....	1	.....	2,500	.....	Fragmentary record.
	1880	.....	.....	3	20	39	.....	.....	.....	62	48,691	.....	45,775	Tenth Census record.
	1903	.....	.....	.....	.....	.....	.....	1	.....	1	.....	.....	40,000	Fragmentary record.
	1894	.....	.....	.....	.....	.....	.....	1	.....	1	.....	15,000	40,000	Do.
Indiana	1871	.....	.....	.....	.....	1	.....	.....	.....	1	1,200	.....	30,000	Do.
	1872	.....	.....	.....	.....	1	.....	.....	.....	1	10,000	.....	.....	Do.
	1880	20	.....	3	52	23	.....	.....	.....	99	90,427	.....	130,335	Tenth Census record.
	1881–1897	.....	.....	.....	.....	.....	.....	11	.....	11	58,000	235,000	470,000	Fragmentary record.
	1898–1911	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	No record.

Iowa	1870							1		1			30,000	Fragmentary record.
	1872	1								1	100			Do.
	1879							1		1			10,000	Do.
	1880	5			26	8			7	46	11,017		45,470	Tenth Census record.
	1881–1911													No record.
Kansas	1879									1	19,200			Mostly prairie; fragmentary record.
	1880	1		1		3			5	10	7,080		14,700	Tenth Census record.
	1884									1	1,300,000			Mostly prairie; fragmentary record.
	1890									1	12,800			Do.
	1907					1				1	38,400			Mostly prairie; National Forest only.
	1908		1				1		1	3				National Forest only.
	1909		4							4	3,200		87	Do.
	1910		9							9	640			Do.
Kentucky	1880	12		10	51	33				106	556,647		237,635	Tenth Census record.
Louisiana	1880				4	2				6	64,410		6,800	Do.
Maine	1795–1849				1			7		8	1,131,500	3,940,000	7,862,000	Fragmentary record.
	1850–1879	2		1	2	1		40		46	237,610	759,000	1,721,000	Do.
	1880	14		3	39	20				76	35,230		123,315	Tenth Census record.
	1881–1900	1		1	5	1		21		29	43,464	152,000	307,000	Fragmentary record.
	1901	3		1	7	3		8		22	6,918		8,405	
	1902													No record.
	1903	19			26	22		61	1	129	269,451		953,243	
	1904	3	1		1	10		16		31	6,958		12,655	
	1905	14		1	26	33		67		141	20,316		63,623	
	1906	6	3	2	8	9	1	33	3	65	7,528		20,919	
	1907	2		1	7	5		18		33	4,524		14,567	
	1908	31	10		32	28	2	125	3	231	142,130	100,000	618,816	
	1909	22	2		37	23	2	68	2	156	39,028		96,699	
	1910	5	1		11	6		11		34	848		2,841	
Maryland	1830–1879							5		5	10,000	30,000	61,000	Fragmentary record.
	1880	16		5	31	14				66	41,076		37,425	Tenth Census record.
	1884									1	200			Fragmentary record.
	1889									1	38,400			Do.
	1892									1	1,000			Do.
	1907										3,873		8,221	
	1908									73	29,091		56,817	
	1909	34		1	13	12	1	24		85	23,277		72,282	
	1910	22		1	23	6		13		65	17,536		96,294	
	1911	17		17	18	6		27		85	70,050		225,801	
Massachusetts	1816–1849		1	3	1	1		13		19	65,820	239,500	486,670	Do.
	1850–1879	2		1				29		32	177,190	999,000	2,216,000	Do.

TABLE 4.—*Forest fires in the United States, Canada, and Newfoundland*—Continued.

State.	Year.	Number of fires caused by—								Total fires.	Area burned.	Damage.		Remarks.
		Railroads.	Lightning.	Incendiary.	Brush burning.	Campers.	Sawmills.	Unknown.	Miscellaneous.			Amount.	Value.	
										Number	*Acres.*	*M. B. F.*		
Massachusetts	1880	52	.....	8	40	56	.....	.....	3	159	13,899	.....	$102,202	Tenth Census record.
	1881-1898	1	.....	1	3	1	.....	20	.....	26	98,530	327,000	756,400	Fragmentary record.
	1899	.....	.....	.....	.....	.....	.....	.....	.....	.....	6,905	.....	58,073	
	1900	.....	.....	.....	.....	.....	.....	.....	.....	.....	51,807	.....	140,456	
	1901	.....	.....	.....	.....	.....	.....	.....	.....	.....	6,125	.....	20,559	
	1902	.....	.....	.....	.....	.....	.....	.....	.....	.....	51,578	.....	26,526	
	1903	.....	.....	.....	.....	.....	.....	.....	.....	.....	11,587	.....	35,513	
	1904	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,339	.....	14,764	
	1905	.....	.....	.....	.....	.....	.....	.....	.....	.....	6,120	.....	32,099	
	1906	.....	.....	.....	.....	.....	.....	.....	.....	.....	11,025	.....	7,300	
	1907	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,178	.....	26,178	
	1908	494	5	92	120	22	12	314	240	1,299	39,672	25,000	205,152	
	1909	497	.....	.....	149	232	5	360	253	1,496	35,083	.....	189,482	
	1910	362	.....	.....	203	199	1	413	207	1,385	42,221	.....	205,383	
Michigan	1871	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,000,000	.....	.....	Fragmentary record.
	1880	43	.....	.....	161	63	.....	.....	.....	267	238,271	.....	985,985	Tenth Census record.
	1881	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,000,000	.....	2,300,000	Fragmentary record.
	1882-1896	.....	.....	.....	.....	.....	.....	9	.....	9	228,000	600,000	1,250,000	Do.
	1897-1903	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	No record.
	1904	.....	.....	.....	.....	.....	.....	.....	.....	3	2	.....	25	
	1905	.....	.....	4	.....	.....	.....	.....	.....	4	200	.....	.....	
	1906	.....	.....	2	.....	.....	.....	.....	1	3	350	.....	.....	
	1907	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Do.
	1908	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,369,067	.....	2,570,446	Do.
	1909	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
	1910	16	.....	.....	.....	1	.....	4	.....	21	1,830	.....	.....	
	1911	33	3	5	36	3	1	88	23	192	161,617	.....	3,340,018	
Minnesota	1870	.....	.....	.....	.....	.....	.....	.....	1	1	40,000	.....	.....	Fragmentary record.
	1880	13	.....	9	40	22	.....	.....	.....	84	250,805	.....	1,395,110	Tenth Census record.
	1894	.....	.....	.....	.....	.....	.....	1	.....	1	160,000	.....	25,000,000	Fragmentary record.
	1895	4	.....	.....	5	4	.....	9	5	27	8,265	.....	3,125	
	1896	9	.....	.....	12	11	.....	33	22	87	14,912	.....	16,059	
	1897	3	.....	.....	27	11	.....	21	8	70	66,020	.....	22,455	
	1898	2	.....	.....	11	9	.....	27	2	51	21,580	.....	9,063	

	1899				3	2			5	10	3,635		1,541	
	1900	9			28	15		81	6	139	179,521		153,399	
	1901	4			17			21	13	55	58,395		42,140	
	1902	3			10			16	5	34	18,285		3,820	
	1903	9			11			25	7	52	15,585		28,292	
	1904	3			12	7		24	4	50	21,920		21,670	
	1905	10		1	35	7		61	6	120	102,968		58,680	
	1906	5			11			22	8	46	11,561		15,115	
	1907	8			6	8		29	3	54	10,385		16,145	
	1908	29			71	27		180	23	330	405,748		2,003,633	
	1909	27			30	9		73	10	149	45,690		61,170	
	1910	183			134	41		477	101	936	1,051,333		1,721,752	
Mississippi	1880	1		1	20	17				39	222,800		78,505	Tenth Census record.
	1909	175		15	150	550	15	500	125	1,530		24,015	332,460	
Missouri	1879							1		1	19,200		40,000	Fragmentary record.
	1880	16		10	41	30				97	783,646		294,865	Tenth Census record.
	1891							1		1			50,000	Fragmentary record.
Montana	1880	1				4				5	88,020		1,128,000	Tenth Census record.
	1882					1				1	45,000	15,000	15,000	Fragmentary record.
	1885			1						1	5,000	8,000	16,000	Do.
	1889		1			1				2	28,000	28,000	70,000	Do.
	1890	1								1	4,000	8,000	16,000	Do.
	1893		1			1				2	38,000			Do.
	1895							1		1	10,000			Do.
	1896						1			1	1,000	2,500	5,000	Do.
	1898							1		1	1,280	2,560	7,680	Do.
	1901									129	7,497			National Forest only.
	1902									38	2,800			Do.
	1903									43	2,027			Do.
	1905			1						1	10,000	1,000	2,000	Fragmentary record.
	1907	58	13		5	11		13	3	103	350	204	263	National Forest only.
	1908	286	66	6	3	41	2	42	5	451	20,115	15,932	27,798	Do.
	1909									338	16,803	6,750	83,507	
	1910									1,129	1,136,113	1,450,630	4,336,021	
	1911	46	54	5	24	31		26	12	198	2,350	70	2,981	Do.
Nebraska	1906		2					1		3	35,455			Mostly prairie.
	1907		3		1			1		5	68,000			Do.
	1908		1						1	2	50,000			Do.
	1909		5						5	10	16,560			Do.
	1910							1	2	3	259,480			Do.
	1911		8					1	1	10	10,500			Do.
Nevada	1880					6				6	8,710		19,000	Tenth Census record.
	1892							1		1	600			Fragmentary record.
	1906					1				1	200		2,000	Do.
	1907	1			1					2	10	3	6	National Forest only.
	1908		1	1		2				4	596	18	68	Do.
	1909			1	1	2		3	3	10	832	15	170	Do.
	1910		5	1		2				8	13	2	6	Do.
	1911		4			2		5	1	12	11		2	Do.
New Hampshire	1828–1849			1	1			2		4	1,000	7,000	14,000	Fragmentary record.
	1850–1879	2			1			17		20	41,000	144,000	288,000	Do.

TABLE 4.—*Forest fires in the United States, Canada, and Newfoundland*—Continued.

State.	Year.	Number of fires caused by—								Total fires.	Area burned.	Damage.		Remarks.
		Railroads.	Lightning.	Incendiary.	Brush burning.	Campers.	Sawmills.	Unknown.	Miscellaneous.			Amount.	Value.	
										Number	*Acres.*	*M. B. F.*		
New Hampshire	1880	12	.....	1	7	7	.....	.....	.....	27	5,954	.....	$63,610	Tenth Census report.
	1881–1907	1	.....	.....	.....	.....	.....	10	.....	11	43,000	107,000	320,000	Fragmentary record.
	1908	.....	.....	.....	.....	.....	.....	.....	.....	399	22,700	21,758	114,605	
	1909	11	.....	.....	23	29	4	57	6	130	2,858	2,223	26,684	
	1910	32	6	17	41	44	6	58	10	214	11,004	.....	55,505	
New Jersey	1782	.....	.....	.....	.....	.....	.....	1	.....	1	100,000	.....	.....	
	1834–1849	.....	.....	.....	1	1	.....	5	.....	7	260,000	900,000	1,800,000	Do.
	1850–1871	.....	.....	.....	2	1	.....	4	.....	7	100,000	600,000	1,200,000	Do.
	1872	.....	.....	.....	.....	.....	.....	.....	.....	.....	100,000	.....	1,000,000	
	1873–1879	.....	.....	.....	.....	.....	.....	2	.....	2	25,000	300,000	600,000	Do.
	1880	28	.....	7	7	6	.....	.....	6	54	71,074	.....	252,240	Tenth Census report.
	1881–1884	.....	.....	.....	.....	.....	.....	5	.....	5	57,000	200,000	400,000	Fragmentary record.
	1885	.....	.....	.....	.....	.....	.....	.....	.....	.....	128,000	.....	1,128,000	
	1886–1894	1	.....	1	1	.....	.....	15	.....	18	150,000	500,000	1,000,000	Do.
	1895	24	.....	4	6	4	.....	6	5	49	66,126	.....	600,000	
	1896	.....	.....	.....	.....	.....	.....	4	.....	4	21,000	75,000	150,000	Do.
	1897–1901	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	No record.
	1902	21	.....	2	22	4	.....	4	12	65	98,850	.....	169,323	
	1903	26	.....	3	21	7	.....	8	14	79	85,046	.....	305,744	
	1904	25	.....	6	13	5	.....	11	21	81	41,530	.....	193,413	
	1905–1906	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Do.
	1907	30	.....	19	7	1	.....	20	19	107	11,325	.....	11,647	
	1908	149	.....	7	39	21	.....	279	38	533	52,978	.....	64,336	
	1909	145	.....	14	62	55	.....	257	30	563	93,525	.....	133,944	
	1910	146	.....	8	64	19	.....	348	26	611	81,452	.....	127,850	
New Mexico	1878	.....	1	.....	.....	1	.....	.....	.....	2	2,000	5,000	10,000	Fragmentary record.
	1880	1	.....	2	37	5	.....	.....	2	47	64,034	.....	142,075	Tenth Census record.
	1883	.....	.....	.....	.....	.....	.....	.....	.....	.....	250,000	200,000	200,000	Indians on warpath.

	1896				1					1	3,840	4,800	4,800	Fragmentary record.
	1898					1				1	12,000			Do.
	1901									81	6,194			National Forest only.
	1902									44	7,832			Do.
	1903									16	141			Do.
	1907	1	4		3	16		37	3	64	8,539	204	374	Do.
	1908	9	7	4	3	54		16	7	100	19,090	5,909	5,447	Do.
	1909	3	12	4	7	50	3	40	10	129	49,877	27,954	94,703	
	1910	4	43	1	7	63	1	43	22	184	48,412	1,995	5,516	Do.
	1911	19	18	3	6	32	1	31	3	113	3,369	360	2,169	Do.
New York	1824–1849	1		1	1	1		12		16	190,000	740,000	1,540,000	Fragmentary record.
	1850–1879	3		1	1	1		36		42	1,350,000	3,000,000	12,000,000	Do.
	1880	43			37	22				102	149,491		1,210,785	Tenth Census record.
	1881–1890	2				1		10		13	86,000	300,000	3,000,000	Fragmentary record.
	1891	7		3	18	15	1	21		65	13,789		19,105	
	1892	8		1	18	3		3		33	1,030		610	
	1893	2		2	5	1		3		13	8,790		9,710	
	1894	10		4	14	11		11		50	17,093		32,041	
	1895	4			14	11		7		36	2,448		4,300	
	1896	9	1	6	41	18		41		116	29,817		35,640	2 per cent State land.
	1897	3		8	11	18		58		98	26,187		26,941	
	1898	16		1	28	16	1	36		98	9,648		7,530	7 per cent State land.
	1899	24	9	9	31	187		62		322	51,565		60,121	6 per cent State land.
	1900	21	3	13	19	36		35		127	14,893		16,499	5 per cent State land.
	1901										7,780		4,000	6 per cent State land.
	1902										21,356		9,150	
	1903	121	1	6	89	99		327		643	464,189		846,082	12 per cent State land.
	1904	21	1	4	20	40	1	14		101	2,627		6,500	4 per cent State land.
	1905	31		5	8	44	1	31	6	126	4,795		3,895	1 per cent State land.
	1906	20		11	9	50		51	1	142	12,500		8,335	2 per cent State land.
	1907	17			6	14		44	1	82	5,653		13,923	1 per cent State land.
	1908	89	9	48	21	224	1	210	3	605	368,072		802,135	14 per cent State land.
	1909	45	4	21	38	170		74	4	356	11,759		23,125	2 per cent State land.
	1910	60	11	22	24	139	2	10	9	277	12,680		17,803	12 per cent State land.
	1911	109	65	37	35	225	1	122	1	595	37,909		43,664	18 per cent State land.
North Carolina	1855							2		2			87,000	Fragmentary record.
	1869							1		1	30,000			Do.
	1880	11	22	25	115	48				221	546,102		357,980	Tenth Census record.
	1881–1908													No record.
	1909	134		24	61	297	18	43	30	607	406,065	37,632	107,254	Total loss, $252,404.
	1910	166		77	77	28	55	141	162	706	579,553	62,018	170,020	Total loss, $526,900.
	1911	113	7	28	108	103	80	58	140	637	160,225	38,550	114,060	Total loss, $448,700.
North Dakota	1886							1		1	130,000			Mostly prairie; Turtle Mountain region.
	1895							1		1	30,000			Fragmentary record.
	1910		1							1		2	5	National Forest only.

TABLE 4.—*Forest fires in the United States, Canada, and Newfoundland*—Continued.

State.	Year.	Number of fires caused by—								Total fires.	Area burned.	Damage.		Remarks.
		Railroads.	Lightning.	Incendiary.	Brush burning.	Campers.	Sawmills.	Unknown.	Miscellaneous.			Amount.	Value.	
										Number	*Acres.*	*M. B. F.*		
Ohio	1872–1879	1			1			3		5	7,040	17,000	$40,606	Fragmentary record.
	1880	27		11	94	60				192	74,114		797,170	Tenth Census record.
	1881–1894	1			1			2		4	44,000	112,000	225,000	Fragmentary record.
	1895–1911													No record.
Oklahoma	1880										1,000			Tenth Census record.
	1903									11	1,510			National Forest only.
	1907			12		2		16	5	35	13,840		58	Do.
	1908			3	1			3		7	280	9	18	Do.
	1909		2	2					9	13	2,432	13	250	Do.
	1910		1		1				1	3	580	10	20	Do.
	1911		1					1		2	820		25	
Oregon	1846								2	2	657,000	4,000,000		Fragmentary record.
	1860							1		1	320,000			Do.
	1868					1		2		3	433,000			Do.
	1880			4	7	16				27	132,320		593,850	Tenth Census record.
	1883					2			1	3			400,000	Fragmentary record.
	1889							1		1			750,000	Do.
	1891							1		1			1,000,000	Do.
	1894					1				1		10,000		Do.
	1896					1				1	5,000			Do.
	1901									114	216			National Forest only.
	1901			1						1		7,000		Fragmentary record.
	1902									129	5,221			National Forest only.
	1902							1		1	170,000	2,124,000	2,955,000	Fragmentary record.
	1903									122	21,296			National Forest only.
	1904			1						1	5,000	100,000		Fragmentary record.
	1907		26	2	3	36		17	4	90	1,502	607	1,003	National Forest only.
	1908		130	40	3	60		81		314	72,310	35,088	51,746	Total loss, $137,182.
	1909									413	61,037	191,213	286,820	
	1910									764	236,732	1,785,869	2,432,119	
	1911	50	229	63		171	5	211	113	842	121,451	87,622	79,684	
Pennsylvania	1839–1879							12		12	97,000	325,000	760,000	Fragmentary record.

	1880	133	.....	102	129	17	.....	.....	.....	381	685,738	.....	3,043,723	Tenth Census record.
	1881–1895	2	.....	1	.....	2	.....	48	.....	53	417,000	1,500,000	2,400,000	Fragmentary record.
	1896	.....	.....	.....	.....	.....	.....	.....	.....	.....	178,982	121,752	557,056	
	1897	.....	.....	.....	.....	.....	.....	.....	.....	.....	191,029	.....	394,327	
	1898	.....	.....	.....	.....	.....	.....	.....	.....	.....	22,853	147,000	735,000	
	1899	.....	.....	.....	.....	.....	.....	.....	.....	.....	214,061	81,000	400,000	
	1900	.....	.....	.....	.....	.....	.....	.....	.....	.....	266,027	.....	834,203	
	1901	.....	.....	.....	.....	.....	.....	.....	.....	.....	73,005	.....	238,374	
	1902	235	9	92	99	37	32	324	23	851	158,572	.....	620,573	
	1903	84	.....	25	22	20	26	84	.....	270	64,186	.....	241,240	
	1904	92	.....	28	23	48	6	116	3	316	63,211	.....	135,873	
	1905	78	.....	25	18	28	20	70	.....	239	18,642	.....	63,915	
	1906	70	.....	36	.....	80	9	80	.....	275	44,495	.....	70,070	
	1907	69	.....	11	19	8	6	52	.....	165	19,389	.....	73,623	
	1908	588	.....	152	145	224	20	835	17	1,961	398,855	.....	688,980	
	1909	64	.....	44	25	69	8	187	1	398	82,152	.....	176,885	
	1910	222	3	73	106	24	45	355	.....	828	98,548	19,165	381,215	Total loss, $391,054.
Rhode Island	1862	.....	.....	.....	1	.....	.....	.....	.....	1	75	.....	.....	
	1886	.....	.....	.....	1	.....	.....	2	.....	3	2,300	50	.....	
	1869	.....	.....	.....	1	.....	.....	1	.....	2	54	.....	.....	
	1883	.....	.....	.....	.....	.....	.....	2	.....	2	400	.....	120,000	
	1891	.....	.....	.....	.....	.....	.....	1	.....	1	100	.....	2,500	
	1909	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12,000	
South Carolina	1880	1	2	.....	39	25	.....	.....	.....	67	431,730	.....	291,225	Tenth Census record.
South Dakota	1878–1879	.....	.....	.....	.....	.....	.....	.....	.....	.....	100,000	.....	.....	Numerous fires.
	1880	.....	.....	.....	4	4	.....	.....	1	9	.....	.....	.....	Tenth Census record.
	1885	.....	.....	.....	.....	.....	.....	1	.....	1	.....	.....	250,000	Fragmentary record.
	1886	.....	1	.....	.....	1	.....	.....	.....	2	23,600	470	1,800	Do
	1900	20	35	.....	7	3	2	17	1	85	13,116	.....	.....	National Forest only.
	1901	.....	.....	.....	.....	.....	.....	.....	.....	88	16,732	.....	.....	Do.
	1902	28	.....	2	1	59	.....	3	.....	93	1,121	.....	.....	Do.
	1903	29	1	.....	1	.....	.....	.....	1	32	115	.....	.....	Do.
	1904	43	1	1	42	.....	.....	6	1	94	1,655	.....	.....	Do.
	1905	17	1	.....	.....	14	.....	.....	.....	32	622	.....	.....	Do.
	1906	56	3	.....	2	6	.....	35	2	104	7,474	.....	.....	Do.
	1907	153	6	.....	.....	11	.....	.....	6	176	1,742	237	735	Do.
	1908	35	2	.....	.....	.....	.....	.....	115	152	8,472	2,610	15,475	Do.
	1909	24	3	2	2	2	2	31	3	69	3,761	443	4,331	Do.
	1910	143	17	.....	5	5	.....	34	2	206	12,340	7,452	23,191	Do.
	1911	61	69	2	13	4	7	54	12	222	8,964	.....	.....	
Tennessee	1880	6	.....	14	38	15	.....	.....	.....	73	985,430	.....	5,254,980	Tenth Census record.
	1910	.....	.....	.....	.....	.....	.....	1	.....	1	30,000	.....	100,000	Fragmentary record.
Texas	1880	.....	4	16	22	9	.....	.....	.....	51	599,359	.....	273,990	Tenth Census record.
	1885	.....	.....	.....	.....	.....	.....	1	.....	1	8,000	.....	20,000	Fragmentary record.
	1886	.....	.....	.....	.....	.....	.....	2	.....	2	175,000	.....	.....	Do.
	1887	.....	.....	.....	.....	.....	.....	1	.....	1	20,000	.....	.....	Do.
	1889	.....	.....	.....	.....	.....	.....	1	.....	1	5,000	.....	.....	Do.

TABLE 4.—*Forest fires in the United States, Canada, and Newfoundland*—Continued.

State.	Year.	Number of fires caused by—								Total fires.	Area burned.	Damage.		Remarks.
		Railroads.	Lightning.	Incendiary.	Brush burning.	Campers.	Sawmills.	Unknown.	Miscellaneous.			Amount.	Value.	
										Number	*Acres.*	*M. B. F.*		
Utah	1847					1				1	240,000	100,000	$300,000	Fragmentary record.
	1880				3	7			3	13	42,865		1,042,890	
	1901									145	422			National Forest only.
	1902									91	2,160			Do.
	1903									18	6,474			Do.
	1907	4				1			5	10	28	2	7	Do.
	1908					1		2		3	150		70	Do.
	1909									74	19,953	3,505	7,019	
	1910	2	5	1	5	7		6		26	4,385	89	186	Do.
	1911	2	2	1	1	4		14		24	1,526		489	Do.
Vermont	1820–1879									5	9,800	31,000	60,000	Fragmentary record.
	1880	5		1	10	2				18	3,941		48,466	Tenth Census record.
	1883				1					1		600	150,000	Fragmentary record.
	1886									1		750		Do.
	1905	5		3	3	4		3	1	19	473		2,233	
	1906			1	2	2		4		9	59		105	
	1907			2	3	1	1	2	1	10	307		2,150	
	1908	4		13	19	20		47	3	106	15,894		31,194	
	1909				5	7		13		25	570		985	
	1910	5	2	1	6	9		19		42	341		1,035	
	1911	3		3	7	11	2	13		39	2,150		6,000	Jan. 1 to June 30 only.
Virginia	1845							1		1			10,000	Fragmentary record.
	1855							1		1		1,500		Do.
	1856				1					1			6,000	Do.
	1868							1		1			100,000	Do.
	1869							1		1			200,000	Do.
	1873							1		1			1,000,000	Do.
	1876							1		1	2,000			Do.
	1893	19			26	12				51	972,319		398,944	Tenth Census record.
	1893							1		1			100,000	Fragmentary record.
	1897							1		1	256,000			Do.
	1898–1911													No record.
Washington	1868							1		1	150,000			Fragmentary record.
	1878							1		1			1,000,000	Do.
	1880									19	37,910		713,200	Tenth Census record.

	1883							1		1	2,560	133,000		Fragmentary record.
	1886							1		1	3,500	87,500		Do.
	1889				1					1	3,000	35,000	20,000	Do.
	1891				2					2	1,850	85,000		Do.
	1892			1	3	2		1		7	7,880	300,000		Do.
	1893			1		1		1		3	4,000	100,000		Do.
	1894			2	6	1		2	1	12	107,000			Do.
	1895			1	1			1		3	1,480	76,000		Do.
	1896			1	2	1		4		8	6,200	195,000		Do.
	1897							3		3	4,500			Do.
	1901									72	1,698			National Forest only.
	1902									147	6,134			Do.
	1902							1		1	434,000	5,026,800	6,600,800	Fragmentary record.
	1903									95	132,513			National Forest only.
	1905									263				
	1906									1,100	107,740		294,430	
	1907									291	10,520		54,600	
	1908									464	21,018		68,890	
	1909									1,312	65,264	147,300	314,217	
	1910									4,923	202,799	150,950	256,125	
	1911	80	49		37	81	4	53	21	325	4,782	10,068	8,654	Do.
	1911										80,900	94,140		
West Virginia	1879										50,000			Fragmentary record.
	1880	7		6	28	13				54	476,775		155,280	Tenth Census record.
	1881–1890													No record.
	1891–1896							5		5	816,000	2,850,000	880,000	Fragmentary record.
	1897–1907													No record.
	1908									710	1,703,850	943,515	2,903,500	
	1909	23		4	10		4	20	9	70	94,322		107,058	
	1910	46		9	41		8	75	44	223	90,407		43,874	
Wisconsin	1871							1		1	1,280,000			Peshtigo fire.
	1874							1		1	80,000			Fragmentary record.
	1880	13		3	78	15				109	406,298		725,610	Tenth Census record.
	1886–1897							10		10	233,000	463,000	2,935,000	Fragmentary record.
	1898												1,000,000	Do.
	1899–1903													State record lost.
	1904	4	1		25	10			100	140	56,777			
	1905	6	3	2	27	19		30	73	160	70,125	12,785	38,355	Total loss, $55,705.
	1906	21	1	1	46	8		20	23	120	35,779	3,000	9,000	Total loss, $21,275.
	1907	36	1		84	37		42	25	215	54,278	5,000	15,000	Total loss, $24,780.
	1908	215			862	358				1,435	1,209,432	499,496	2,996,975	Total loss, $3,147,319.
	1909	65			189	28		65	65	412	166,751	4,168	21,793	Total loss, $36,151.
	1910	288			365	65		484	105	1,307	892,833	208,913	997,023	
	1911	17			20	7	1	57	4	106	58,000	4,583	9,983	
Wyoming	1876							1		1	500,000			Fragmentary record.
	1880					5				5	83,780		3,255,000	Tenth Census record.
	1886					1				1	7,000			Fragmentary record.

TABLE 4.—*Forest fires in the United States, Canada, and Newfoundland*—Continued.

State.	Year.	Number of fires caused by—								Total fires.	Area burned.	Damage.		Remarks.
		Railroads.	Lightning.	Incendiary.	Brush burning.	Campers.	Sawmills.	Unknown.	Miscellaneous.			Amount.	Value.	
										Number	*Acres.*	*M. B. F.*		
Wyoming	1888							1		1	10,000			Fragmentary record.
	1889							1		1	8,920	26,500	$26,500	
	1890							1		1	10,000			Do.
	1891							1		1	20,000			Do.
	1892					1				1	3,200	6,400	6,400	Do.
	1893							3		3	114,400			Do.
	1897							2		2	257,500			Do.
	1898										76,000			Several fires.
	1899							1		1	30,000			Fragmentary record.
	1900					1		5		6	137,000			
	1901									55	25,505			National Forest only.
	1902									71	4,667			Do.
	1903									52	93,546			Do.
	1907		2		2	18		11	1	34	379	1,027	632	Do.
	1908	1	5			11		3		20	2,289	2,121	4,721	Do.
	1909	3	1		2	15		4	3	28	2,028	828	3,866	
	1910	31	39	2	4	50	1	27	3	157	33,104	15,529	27,654	
	1911		15		4	41	3	18	2	83	3,464	3	21,656	Do.
Alaska	1902							1		1	1,000,000			Fragmentary record.
	1910					1		2		3	72,500			Do.
	1911							1		1	100,000			Do.
	1912							1		1	1,000,000	500,000		Do.
CANADA.														
British Columbia	1885							1		1			40,000	Fragmentary record.
	1886				1					1			1,000,000	Includes town of Vancouver.
	1908							1		1	64,000	960,000	1,920,000	Fragmentary record.
	1908												25,000,000	Canadian forestry journal.
	1909									489	70,000		18,400	
Dominion Lands	1880							1		1	11,520			Mostly prairie; fragmentary record.
	1909	20	22	1		142	1	244	7	487	251,000		45,000	
	1910	188	55	33		400		343	208	1,227				
New Brunswick	1825							1		1	2,500,000			Miramichi fire.
	1858							1		1	25,600			Fragmentary record.
	1891							1		1	6,400			Do.
	1894							1		1			10,000	Do.
	1909							1		1	103,000			Do.

Nova Scotia	1901	2				1		4		7	14,000	50,000	100,000	Do.
	1902										315,000		500,000	
	1903										200,000		2,000,000	
	1908									7				
	1909									93	10,000		10,000	
Ontario	1845							1		1	64,000			Do.
	1855							1		1	130,000			Do.
	1867							1		1	1,250,000			Do.
	1868							1		1			3,000,000	Do.
	1870							1		1	100,000			Do.
	1871							1		1	1,250,000			Do.
	1874							1		1	6,400		1,080,000	Do.
	1881							2		2				Do.
	1883	86	3	37	184	153	2		1	466				
	1884							1		1	28,100			Do.
	1887							2		2			650,000	Do.
	1888							1		1			500,000	Do.
	1898				1					1	10,000	20,000	1,000,000	Do.
	1901									8				Do.
	1902									50			10,000	Do.
	1909												100,000	
Quebec	1825							1		1	3,200			Do.
	1853							1		1	1,600,000			Do.
	1858							1		1			100,000	Do.
	1868												3,000,000	Do.
	1870							1		1	96,000		400,000	Do.
	1871							1		1			2,000,000	Includes 6 villages.
	1875							1		1		6,000		Fragmentary record.
	1880							2		2	300,000		600,000	Do.
	1881							2		2		3,000	62,000	Do.
	1894							1		1			80,000	Do.
	1906	2	16		15	10		27		70	1,000			
	1907	4			21	10		10		45	2,000			
	1908	12	2		24	20		72		130	15,000			
	1909	12		1	25	10		50	2	100	3,000			
	1910	20	5		30	15		80		150	3,000			
	1911	35	7		25	20		115	33	235	5,000			
NEWFOUNDLAND.														
Newfoundland	1911	2						3		5	22,923	100,973		

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