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PROPERTY LOSS BY LIGHTNING IN THE UNITED STATES, 1899.

By ALFRED J. HENRY, Professor of Meteorology.

In 1898 systematic efforts were made by the United States Weather Bureau to ascertain the frequency of damaging or destructive lightning strokes throughout the United States. The results of the first year's work were published in Weather Bureau Bulletin No. 26, Lightning and Electricity of the Air, and also separately as Weather Bureau No. 199, Property Loss by Lightning, 1898. The collection of statistics bearing upon the loss of and damage to property was continued during 1899. As heretofore, dependence has been placed upon the reports furnished by agents and adjusters of farmers' mutual insurance companies, supplemented by press clippings obtained through one of the large newspaper-clipping agencies.

Farmers' mutual insurance companies operate mainly in the States of Illinois, Iowa, Minnesota, Wisconsin, Michigan, Nebraska, Missouri, Indiana, and Ohio. It may be assumed that for these States the returns that have been received are substantially correct as far as they go; it is not to be expected, however, that in a purely voluntary service, such as was freely given by the farmers' mutual companies, returns would be made for each loss sustained or that agents and adjusters would uniformly cooperate with the Weather Bureau. While the cooperation was much more complete in some States than in others, it does not necessarily follow that the statistics for one State are less complete than those for another, except in matters of detail. In general, newspaper clippings were relied upon to supply any lack of data that might be caused by failure of the mutual insurance companies to report their losses. At this point the question might naturally be asked, what proportion of damaging lightning strokes is reported to the newspapers? A categorical answer can not be given; probably three-fourths, possibly more. As a general proposition it may be assumed that substantially all of the larger losses, whether they occur in city or country, are sooner or later reported to the press. In the more thickly populated States the county newspaper generally contains a faithful chronicle of destruction by lightning throughout the county. It is only in the sparsely settled States and Territories that accounts of destructive flashes will fail of publication. There are, of course, many cases of lightning stroke in all communities accounts of which never appear in the public prints, mainly because the damage done is of little or no consequence.

The total number of reports received of buildings struck and damaged or destroyed by lightning during the calendar year 1899 was 5,527, about three times as many as were received during the previous year. In addition to the above number, 729 buildings caught fire as a result of exposure to other buildings that had been set on fire by lightning. The approximate loss in the 2,825 known cases was $3,016,520, or an average loss of nearly $1,100 per building. It would not be correct to assume that the same rate of loss was maintained in the remaining 3,431 buildings, for, as a general rule, it is only in the small and insignificant cases of damage or loss that the details are lacking. The number of insured buildings in the United States struck by lightning during 1899, according to the Chronicle Fire Tables, New York, 1900, was 2,760, with a total loss, including exposures, of $3,913,525, or an average of a little over $1,400 per building. These figures are largely in excess of the corresponding values for 1897 and 1898.

A summary of the material on which the report is based will be found in Table 1. The classification of buildings adopted in that table is practically the same as that of 1898.

The value of the data included in columns 7 to 13 is somewhat impaired by the fact that no information was obtainable in regard to a large proportion of the cases. The results, so far as obtained, agree closely with those of the previous year. The great majority of buildings struck by lightning were not provided with lightning rods, as was the case in 1898, but on the other hand 70 buildings provided with rods were struck and damaged.

Columns 17 and 18 have been added from the Chronicle Fire Tables for the purpose of comparison. It will be seen that, while there is a general agreement between the amounts reported in columns 16 and 18, respectively, there are several wide discrepancies. It is quite evident that the statistics collected by the Weather Bureau, which include both insured and uninsured property, fall short of representing the entire amount of loss by lightning. One of the significant facts of the table is the large number (3,431) of unknown cases of loss or damage. A conservative estimate of the total loss by lightning during the year would probably be $6,000,000.

In addition to the statistics of Table 1, a considerable number of strokes was reported as falling upon various structures,

TABLE 1.—*Reports received of buildings struck and damaged by lightning in the United States in* 1900.

States.	Total number.*	Kind.				Character of roof.				Rods.			Loss.			Loss of insured property.	
		Barns, sheds, warehouses, mills, factories.	Churches, schools, theaters, halls.	Dwellings, stores, office buildings.	Electric power plant.	Wood.	Slate	Metal.	Unknown.	Yes.	No.	Unknown.	Known cases of—	Unknown cases of—	Amount on buildings and contents.	Number of cases.	Total loss, including exposures.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Alabama	28	6	2	19	1	11		1	16	2	11	15	16	12	$21,654	9	$9,225
Arizona	7			7		4		1	2		6	1	6	1	4,380	1	1,000
Arkansas	11	5	1	5		1			10		1	10	3	8	1,025	3	3,700
California	6	2	1	2	1	1			5		1	5	5	1	29,050	4	17,450
Colorado	14			14		4	1		9		4	10	6	8	775	4	5,620
Connecticut	145	61	5	79		13	2		130		3	142	43	102	37,986	92	77,835
Delaware	27	10	3	14		3			24		2	25	9	18	6,850	10	11,300
District of Columbia	5	1	1		3	1	1		3		1	4	4	1	1,360		
Florida	22	4	1	17		5			17		4	18	6	16	8,357	4	10,100
Georgia	36	14	5	17		4			32		5	31	10	26	24,395	20	17,800
Idaho																3	25
Illinois	417	223	29	161	4	121	4	3	289	10	100	307	228	189	109,137	139	200,055
Indiana	197	100	16	80	1	40	8	8	141	4	36	157	103	94	101,750	89	117,565
Iowa	273	152	21	98	2	83			190	2	76	195	148	125	101,484	121	142,470
Kansas	76	30	3	42	1	9			67		9	67	31	45	22,749	39	42,450
Kentucky	61	27	7	26	1	5	1	1	54		6	55	23	38	26,834	30	28,895
Louisiana	6	1	2	3					6			6	4	2	2,075	4	5,550
Maine	208	126	7	73	2	5			203			208	78	130	121,185	70	143,990
Maryland	129	66	10	52	1	23	7	4	95	1	25	103	66	63	69,972	66	79,290
Massachusetts	276	100	26	142	8	20	9		247	1	9	266	93	183	147,480	140	142,425
Michigan	287	151	24	106	6	31	2		254	1	31	255	146	141	290,332	146	340,875
Minnesota	116	54	15	45	2	32		1	83		31	85	71	45	65,910	62	80,375
Mississippi	17	2	1	13	1	1	1		15	1	1	15	3	14	1,337	1	2,000
Missouri	155	61	17	75	2	35	2	1	117	3	32	120	72	83	31,264	46	54,825
Montana	12	4		7	1	2			10		3	9	6	6	258		
Nebraska	140	63	16	61		43	1	3	93	2	42	96	84	56	38,510	49	32,605
Nevada																	
New Hampshire	94	45	4	42	3	1	1		92		1	93	32	62	45,875	66	76,750
New Jersey	369	146	29	187	7	31	18	3	317	3	27	339	127	242	182,540	93	311,745
New Mexico	1			1					1			1	1		4,000	1	40,000
New York	1,080	629	56	381	14	302	28	19	731	18	308	754	539	541	491,098	399	563,730
North Carolina	46	25	4	16	1	10		2	34		11	35	24	22	15,154	18	38,540
North Dakota	20	11		9					20		2	18	6	14	24,785	23	15,550
Ohio	596	310	52	229	5	93	41	11	451	8	112	476	267	329	162,618	216	190,935
Oklahoma and Indian Territory	4	3		1		2			2		1	3	2	2	2,150	3	3,450
Oregon	2	1		1					2			2		2		2	600
Pennsylvania	719	400	44	269	6	27	16	1	675	9	19	691	237	482	479,155	412	515,110
Rhode Island	28	5	3	20		1		1	26			28	8	20	930	24	10,060
South Carolina	42	12	1	27	2	23		2	17	1	25	16	28	14	7,616	7	4,060
South Dakota	76	36	7	33		25		3	48	1	28	47	43	33	25,170	24	22,350
Tennessee	33	19	1	13		16	1		16	1	14	18	19	14	14,437	17	11,835
Texas	30	9	6	15		5	1	1	23		5	25	10	20	1,795	11	5,500
Utah	5	4			1	2			3		2	3	1	4	1,250		
Vermont	73	54	3	16			1		72			73	30	43	42,745	72	79,975
Virginia	56	29	2	25		10	2	1	43		7	49	27	29	18,855	33	39,580
Washington	3	3							3			3		3			
West Virginia	49	20	3	25	1	7	2	3	37		8	41	20	29	132,090	40	202,635
Wisconsin	258	136	28	92	2	70	3	1	184	2	60	196	140	118	98,148	145	213,005
Wyoming	1			1					1			1		1		2	700
Total	6,256	3,160	456	2,561	79	1,122	153	71	4,910	70	1,069	5,117	2,825	3,431	3,016,520	2,760	3,913,525

* The total number of strokes was 5,527; the figures given in this column include buildings set on fire by exposure to fires caused by lightning.

such as windmills, derricks, oil tanks, water tanks, coal breakers, bridges, vessels, railway cars, thrashing machines, cotton bales, grain in shock, etc. The damage to property of this character, so far as reported, was $215,622. Two very large losses, one of $90,000 the other of $65,000, are included in that sum.

In 1898, 52 per cent of the buildings struck were barns, sheds, warehouses, etc.; in 1899 the percentage of such buildings struck was 50; in 1898, 40 per cent of all buildings struck were dwellings, stores, and office buildings; in 1899 the percentage was exactly the same. Five per cent of all buildings struck in 1898 were churches and schools; in 1899 the percentage of such buildings struck had increased to 7. The agreement of these facts can scarcely be considered as a mere coincidence; it is more reasonable to suppose that lightning flashes fall upon buildings in about the proportions given above.

The number of electric power plants struck by lightning during the year was 79. It is probable, however, that a number of these were light discharges due simply to induction produced by the surgings of lightning strokes, within or near the field covered by the local circuits.

Careful watch was kept for cases of overhead trolley cars being struck by lightning. It was often difficult to differentiate between cases of direct lightning stroke and simple induced charges. The latter were very frequent and rarely resulted in more serious damage than the burning out of fuses. Some well authenticated cases of direct lightning stroke were observed, but in no instance was there loss of life or great destruction of property. More injuries to life and limb were occasioned by the occupants jumping from the cars while yet in motion than by the effects of the lightning flash. It is but natural that persons should become greatly terrified when an unusual discharge manifests itself on the car; experience has clearly shown, however, that the only thing to do is to sit still until the journey is completed.

Table 2 gives the number of reports of live stock in the fields killed by lightning during 1899, and the approximate value of the same.

The total number of strokes reported was 1,803 and the approximate value of the stock killed was $129,955. The number of strokes was about two and a half times as great as during the preceding year and the value of the stock killed was nearly three times as great. The increase in the number of live stock killed is directly proportional to the increase in the number of buildings struck.

The six States having the greatest number of fatal cases are as follows: Iowa, New York, Nebraska, Illinois, Ohio, and Wisconsin.[1] It will be observed that all these States are occupied by farmers' mutual insurance companies and it is to them that we are indebted for the completeness of the reports.

TABLE 2.—*Live stock in the fields killed by lightning during* 1899.

States.	Cattle.	Horses.	Mules.	Pigs.	Sheep.	Goats.	Value.	No. of strokes.
Alabama	2	4	5				$635	8
Arizona	9	7					685	9
Arkansas	1						15	1
California	4	3			11		233	4
Colorado	34	24	1				2,375	32
Connecticut	35						930	15
Delaware	1	4					320	4
District of Columbia								
Florida	2	3					205	3
Georgia	1	1	7	8			540	7
Idaho								
Illinois	236	105	5	24	1		16,061	164
Indiana	30	30	1	4	5		3,749	33
Iowa	483	87	2	19	67		20,120	333
Kansas	90	19	1				3,525	29
Kentucky	11	9	1		62		1,436	16
Louisiana								
Maine	19	1		1			440	15
Maryland	46	19		2	3		3,142	31
Massachusetts	33	3		2	4		930	14
Michigan	22	26		12	90		2,879	39
Minnesota	31	10		13	3		1,517	28
Mississippi	2	3	1				330	5
Missouri	114	28	7				7,191	64
Montana	5	3					410	5
Nebraska	220	41	1	45			9,763	176
Nevada		1					75	1
New Hampshire	21	3		4	8		689	16
New Jersey	46	10	1	6	85		2,147	36
New Mexico	7	1				53	315	5
New York	249	53		7	144		12,412	193
North Carolina	13	1	4	5	12		851	16
North Dakota	10	15					1,205	10
Ohio	160	75		39	127		13,008	143
Oklahoma and Indian Territory			1				50	1
Oregon								
Pennsylvania	151	33		6	70		6,023	85
Rhode Island	4	1					135	4
South Carolina	2	2	2				350	6
South Dakota	52	37		5	4		4,045	55
Tennessee	21	8	9		4		1,580	18
Texas		1					75	1
Utah								
Vermont	32	5					1,010	17
Virginia	22	11		8	43		1,869	20
Washington								
West Virginia	31	4	2		33		1,802	24
Wisconsin	129	22		28	40		4,808	116
Wyoming		1					75	1
Total	2,381	714	51	238	816	53	$129,955	1,803

MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Señor Manuel E. Pastrana, Director of the Central Meteorologic-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the Boletin Mensual. An abstract, translated into English measures, is here given, in continuation of the similar tables published in the MONTHLY WEATHER REVIEW since 1896. The barometric means have not been reduced to standard gravity, but this correction will be given at some future date when the pressures are published on our Chart IV.

[1] The relative area of the States will be found on page 397 of the MONTHLY WEATHER REVIEW for September, 1900.—ED.

Mexican data for October, 1900.

Stations.	Altitude.	Mean barometer.	Temperature. Max.	Temperature. Min.	Temperature. Mean.	Relative humidity.	Precipitation.	Prevailing direction. Wind.	Prevailing direction. Cloud.
	Feet.	*Inch.*	° *F.*	° *F.*	° *F.*	%	*Inch.*		
Durango (Seminario)	6,243	24.05	87.8	38.7	65.7	50	0.25	wsw.	sw.
Guanajuato	6,640	23.70	85.1	48.2	66.6	52	0.23	ne.	e.
Leon (Guanajuato)	5,934	24.30	82.6	44.6	65.3	54	0.17	nw.	e.
Magdalena (Sonora)	2,618				70.0			s.	ne.
Mazatlan	25	29.87	91.9	71.1	82.4	75	1.30	nw.	nw.
Merida	50	29.88	93.2	63.0	78.8	78	0.83	ne.	e.
Mexico (Obs. Cent.)	7,472	23.07	77.0	44.6	61.5	58	0.12	n.	ne.
Morelia (Seminario)	6,401	24.00	79.0	45.7	61.5	74	1.00	w.	ne.
Tampico	38	29.95	90.9	59.0	78.8	74	4.80	se.	

CUMULUS CLOUDS AT THE BAYONNE, N. J., FIRE.

By JOHN H. EADIE, Voluntary Observer, Bayonne, N. J.

I have read with much interest Mr. W. H. Mitchell's account of the great fire at the Standard Oil works in this place in July last, and can vouch for the accuracy of his description, although he describes several details which his close proximity enabled him to see and which were not witnessed by others. There is one matter, however, which he writes of with apparent confidence that I am not yet convinced is correct, viz, the formation of cumulus clouds over the column of smoke. I, too, saw these so-called clouds, although at a greater distance than Mr. Mitchell's station. I could not divest myself of the opinion that they were due to the illumination of the upper surface of the dense smoke column by the slanting rays of the sun, as they were not observed except where the smoke was densest. The column was very black, but it gave the appearance of being solid enough to reflect sunlight near its upper part.[1] No other clouds were near at the time and I could not avoid thinking that the so-called cloud owed its origin to the cause mentioned.

DRIFT ICE AND THE THEORY OF OCEAN CURRENTS.[2]

By REGINALD A. DALY.

The extraordinary smoothness of the sea covered by drift ice, even when the pans are widely spaced, is truly astonishing to one making his first voyage in such waters. His sailing ship may be favored with a fresh breeze, and yet the ocean surface be quite level, save for the minute rippling characteristic of a small pond ruffled by a summer breeze; ground swell does not exist. It is a matter of common knowledge among the fishermen of the Atlantic Labrador coast that the Labrador current, or "tide," as they invariably express it, often shows high velocity, although its surface for a length of 1,000 miles and a breadth of from 100 to 300 miles is covered with loose pan ice. At such times the wind is or has been strong and from a northerly quarter. We are justified in believing that the pans act as the sails which, in ice-free waters, are represented by wind waves. Floes and pans project above the surface from 1 to 20 feet or more. They may be expected to exert a coercive force on the film of relatively fresh water derived from the melting of the ice in contact with the heavier salt water beneath. According with the behavior of such "dead water," as described by Nansen and others, the light surface layer will tend to move *en masse* and in the direction of common pull exercised by the wind-driven masses of ice. By reason of friction the motion will be com-

[1] The Editor would suggest that observers favorably situated should observe and report whether in any case smoke clouds can so reflect sunlight as to appear like vapor clouds.

[2] Extracted from Science, November 2, 1900, Vol. XII, p. 688.