SCIENCE

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THE AUGUST STORMS.*

BY WALTER C. KERR, NEW BRIGHTON, STATEN ISLAND.

THE havoc wrought upon vegetation in the vicinity of New York city by the recent storms perhaps deserves notice, especially considering the opportunity afforded to compare the effects of two destructive gales, only four days apart. These storms though quite similar in general character differed widely in one feature, whose destructive power might escape general notice or at least be much underrated. This feature is the amount of water in the air, which largely augments the weight of the moving column and at high velocities transforms the usually harmless wind into a formidable battering ram.

Some time since Mr. William T. Davis, of New Brighton, Staten Island, mentioned that the comparative scarcity of large trees in that vicinity was probably due to high gales, and when the results of recent storms are viewed, there can be little doubt regarding this cause.

The gale of August 24 is generally credited with having uprooted or broken more trees in this locality than any on record. This destruction of vegetation was widespread. In the cities and towns the streets were blocked with fallen trees and branches while the country roads were in many places impassable. Numerous white oak and chestnut trees were uprooted that to all appearances should have offered great resistance. This storm had a comparatively low wind-velocity, and a great rainfall.

The gale of August 29th caused some damage to vegetation, though not nearly so much as that of the 24th. At sea it was one of the worst storms experienced in this latitude for years. It was characterized by a very high wind with little rain.

It may be said that the first storm destroyed the weak trees, leaving little for the second and greater one to wreck. On the other hand it may be presumed that the first storm would cause much weakening and facilitate the efforts of the greater wind that followed.

The first storm had a maximum velocity of forty-eight miles, reached by our winds about once each month without sensible damage, while the maximum velocity of the second, sixty miles, is attained less frequently than once a year and only rarely is this high rate destructive to vegetation.

The following official records from the United States Weather Bureau, N. Y., furnish accurate comparisons :

August 24, rainfall 3.81 inches from 7.52 P. M. August 23d to 8.15 A. M. August 24.

Time,	12	1	2	3	4	5	6	7	8
Wind velocity,	29	33	27	28	29	30	23	20	

Maximum velocity for one hour, thirty-seven miles at 2 A. M.

Maximum rate for one mile, forty-eight miles between 1 and 2 A. M.

Between 2 and 3 P. M. August 24, the wind averaged thirty-five miles, with a maximum rate for one hour of forty-two miles. At this time no rain fell and no damage resulted.

August 29, rainfall .28 inches from 4 A. M. to 8 A. M.

Time,	12	1	2	3	4	5	6	7	8
Wind velocity,	24	31	33	38	38	44	40	32	

Maximum velocity for five minutes, fifty-four miles at 5 A. M.

Maximum rate for one mile, sixty miles at 5 A. M.

At this station of the United States Weather Bureau a wind velocity of forty to fifty miles is attained once a month, a wind velocity of sixty miles is attained scarcely once a year, a wind velocity of seventy-two miles is the highest on record.

These figures show conclusively that, as ordinarily measured, the second storm was by far the greater; in fact, as the wind pressure is proportional to the square of the velocity, it may be seen that the effect due to wind pressure alone on August 29, should have been nearly double that of August 24.

When we, however, give value to the relative rainfalls, 3.81 inches as against .28 inches, the destructiveness of the wet gale of August 24 becomes apparent.

In a storm a tree must resist a column of air moving at a high velocity and to a large degree consume its energy. This energy is proportional to the mass and the square of the velocity. Dry air has small mass per cubic foot, yet at forty miles per hour yields a pressure of eight pounds per square foot; at fifty miles twelve pounds; at sixty miles eighteen pounds; at eighty miles thirty-two pounds; and at 100 miles fifty pounds. If we add to each cubic foot of air one-tenth of one per cent, by volume, of moisture, as, for instance, by partly filling it with rain drops, its weight will be nearly doubled(.0753 plus .0625), and in consequence the energy of the moving mass will be likewise doubled. One-half of one per cent of water added to the air increases the energy five-fold, and thus the wind at its maximum velocity of forty-eight miles on August 24, if burdened with this amount of moisture, would have an effect greater than a dry hurricane of 100 miles. When rain falls in calm but little water is contained per cubic foot of air, but with high winds the rainfall of a large area may be carried along nearly horizontally and massed where intercepted by vertical obstacles. It is therefore reasonable to presume that trees in exposed situations receive vastly more water per square foot of surface than is measured by rain gauges in the usual way.

When wet the resistance of foliage to passing wind and rain is doubtless increased, especially when there is a tendency for the leaves and branches to mat together on the windward side, while the weight of water carried by the tree may be a considerable additional burden.

It thus becomes easy to appreciate the enormous part which water plays in the destructive force of high winds on exposed trees, as well as on the more commonly noticed windfallen grain and corn.

*Paper read at a recent meeting of the Natural Science Association of Staten Island.