Bulletin No. 40.—W. B. No. 471. Issued March 4, 1912.

U. S. DEPARTMENT OF AGRICULTURE,

WEATHER BUREAU.

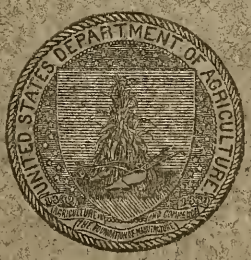
THE RELATION BETWEEN THE PRECIPITATION OVER THE WATERSHED OF THE OHIO RIVER ABOVE AND THE STREAM-FLOW AT CINCINNATI.

BY

J. WARREN SMITH,

PROFESSOR OF METEOROLOGY.

Prepared under direction of WILLIS L. MOORE, Chief U. S. Weather Bureau.



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LETTER OF TRANSMITTAL.

United States Department of Agriculture,
Weather Bureau, Office of the Chief,
Washington, D. C., September 20, 1911.

The Secretary of Agriculture,
Washington, D. C.

Sir: I have the honor to transmit herewith a paper by Prof. J. Warren Smith, of the Weather Bureau, on the Stream Flow of the Ohio River at Cincinnati and Precipitation, and to recommend its publication as a Weather Bureau bulletin, the edition to consist of 2,500 copies.

Very respectfully,

Willis L. Moore,
Chief United States Weather Bureau.

Approved.

James Wilson,
Secretary of Agriculture.

STREAM-FLOW OF THE OHIO RIVER AT CINCINNATI AND PRECIPITATION IN THE WATERSHED ABOVE CINCINNATI.

INTRODUCTION.

In the following paper the relation between the precipitation over the Ohio watershed above Cincinnati and the stream-flow in the Ohio River at Cincinnati is discussed.

The period covered is for 50 years, from 1861 to 1910, inclusive. The data are tabulated for each month of each year, for each month of 10-year and 25-year groups of years, and for combinations of months for each year of the entire period.

The precipitation data considered were obtained from seven stations in the Ohio River watershed above Cincinnati, the period of observations covering the 50 years from 1861 to 1910, inclusive. The data are complete for the 50 years at Cincinnati, Marietta, and Portsmouth, Ohio. At Lexington, Ky., the records extend from 1861 to 1876 and from 1887 to 1910, all inclusive, while from 1882 to 1886, inclusive, the records at Frankfort, Ky., were used. The record at Pittsburgh, Pa., extends from 1861 to 1866, and from 1872 to 1910, all inclusive, while from 1867 to 1871, inclusive, data from Canonsburg, Pa., were used. The data at Westerville, Ohio, were complete from 1861 to 1901, inclusive, while from 1902 to 1910, inclusive, those for the Ohio State University were used. In the place of North Lewisburg, Ohio, the data for Urbana, Ohio, were used for the years 1909 and 1910. In each instance where data from two stations were used, the places were not far apart, and there is probably no great difference in the precipitation.

It is unfortunate that there are no stations with long records in West Virginia or at other points south of the Ohio River. It is quite probable that the means obtained from the seven stations used do not always give the true average precipitation for the Ohio watershed above Cincinnati. Still, it was thought better to use the same stations running through the 50-year period than to consider data from other sources.

Chart No. 1 indicates the locations of the stations.

For the stream-flow data, instead of considering the average height of the water, we have tabulated the total number of days in each month when the river was between each 10-foot stage.

Inasmuch as navigation is satisfactory in the Ohio when the river at Cincinnati is between 10 and 40 feet, we have considered the low-water days as those below 10 feet, and the high-water days as those above 40 feet.

The flood stage is 50 feet at Cincinnati, but there is more or less trouble in navigating the stream when the river is above 40 feet because of strong currents, swirls, débris, and, in its season, ice.

The work of tabulation has been great, and we have tried to group the data in every possible way to show the relation of the factors under consideration. An effort has been made to make the study exhaustive, plain, and convincing.

It seems to the writer that the statements made in the conclusions following are proven beyond dispute, and that the question of increasing flood conditions and increasing low-water periods is fairly settled in the negative, so far as our available stream-flow data can settle it.

CONCLUSIONS.

1. River stages at Cincinnati depend upon the precipitation over the *whole* watershed above that city.

2. There has been a very slight decrease in flood days in recent years, with the same rainfall.

3. The same amount of rainfall causes a better flow of water in the river during the low-water period than formerly. The number of low-water days was 14 per cent less during the past 25 years than during the preceding 25, calculating for the same rainfall. During the 10 years ending with 1910 the tendency for low water, with an equivalent rainfall, was not so great as for any preceding 10-year period for the past 50 years.

4. Floods do not occur at Cincinnati during February and March unless the precipitation for these months is in excess of the normal, except on *very* rare occasions. The number of flood days increase most rapidly when the precipitation during these months is about 3 inches above the normal or about one-half more than the normal.

EXPLANATION AND DISCUSSION OF TABLES.

Table No. 1.

In this table there is given for each month of each year from 1861 to 1910, inclusive, the total number of days that the river at Cincinnati, Ohio, was below 5 feet, between 5 and 5.9 feet, 10 and 19.9 feet, 20 and 29.9 feet, 30 and 39.9 feet, etc., up to the highest water recorded.

These figures were obtained from the published daily river reading tables. By an inspection of the table the high and low water months can be quickly determined.

For example, in January, 1897, the water did not go above 20 feet during the month, the only January in the 50 years when this was true. On the other hand, the river reading was at no time below 20 feet in January, 1870, 1882, 1889, 1891, and 1907. The river has been above 60 feet on only 6 days in January, and this in 1907.

There are some interesting periodicities or combinations indicated. For example, there seemed to be increasing flood conditions in February, 1881 to 1884, and again from February, 1888 to 1891, but in the succeeding years the river was back to below normal height.

The river did not go above 20 feet in June from 1871 to 1879, inclusive. September seems to be a month of extremes; on a few years the river has not gone above 5 feet during the entire month, and in 2 cases the readings were all above 10 feet.

TABLE 1.—*Number of days during each month and year when the river reading at Cincinnati, Ohio, was between the heights indicated, 1861 to 1910.*

Years.	0 to 4.9 feet.	5 to 9.9 feet.	10 to 19.9 feet.	20 to 29.9 feet.	30 to 39.9 feet.	40 to 49.9 feet.	50 to 59.9 feet.	60 to 69.9 feet.	70 to 79.9 feet.
JANUARY.	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*
1861			15	8	6	2			
1862			12	6	3	4	6		
1863			15	4	11	1			
1864		6	16	9					
1865			8	14	9				
1866			9	14	8				
1867			26	5					
1868			16	6	6	3			
1869			7	9	15				
1870				15	6	4	6		
1871		14	10	4	3				
1872		11	15	5					
1873			10	17	4				
1874			5	10	10	6			
1875		5	18	4	4				
1876			7	9	4	10	1		
1877			13	4	5	4	5		
1878		4	10	17					
1879			13	6	12				
1880			1	19	8	3			
1881		5	8	13	5				
1882				2	6	23			
1883			20	9	2				
1884			10	13	8				
1885			11	12	3	5			
1886			9	17	5				
1887			17	9	2	3			
1888		4	12	9	6				
1889				26	5				
1890			2	9	14	6			
1891				17	8	6			
1892			12	13	4	2			
1893		5	24	2					
1894			29	2					
1895		5	1	10	10	5			
1896		11	12	8					
1897		1	30						
1898			9		6	11	5		
1899			2	12	9	8			
1900		7	9	10	5				
1901		4	20	7					
1902		6	14	4	5	2			
1903			12	13	6				
1904			21	4	2	4			
1905		1	25	5					
1906			5	17	9				
1907				3	9	8	5	6	
1908			14	17					
1909		1	21	9					
1910		2	5	7	9	8			

TABLE 1.—*Number of days during each month and year when the river reading at Cincinnati, Ohio, was between the heights indicated, 1861 to 1910*—Continued.

Years.	0 to 4.9 feet.	5 to 9.9 feet.	10 to 19.9 feet.	20 to 29.9 feet.	30 to 39.9 feet.	40 to 49.9 feet.	50 to 59.9 feet.	60 to 69.9 feet.	70 to 79.9 feet.
FEBRUARY.	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*
1861			7	11	10				
1862			3	4	11	10			
1863			1	10	16	1			
1864		7	11	11					
1865			12	13	1	2			
1866			13	11	4				
1867			2	5	6	8	7		
1868		3	23	3					
1869			4	21	3				
1870			10	10	8				
1871			7	19	2				
1872		9	17	3					
1873			6	7	12	3			
1874			7	10	6	5			
1875		4	16	7	1				
1876			3	7	9	10			
1877		1	18	6	3				
1878			3	23	2				
1879			4	17	5	2			
1880			12	7	3	3	4		
1881			7	5	7	7	2		
1882				4	4	11	9		
1883				5	5	2	9	7	
1884				2	2	6	6	11	2
1885		4	17	7					
1886			5	14	8	1			
1887						18	10		
1888		3	8	18					
1889			12	9	7				
1890				3	12	10	3		
1891					2	18	8		
1892			7	22					
1893				4	10	6	8		
1894			5	12	11				
1895			28						
1896			11	13	5				
1897			4	5	7	6	4	2	
1898			9	7	12				
1899			9	7	12				
1900			8	12	8				
1901		4	23	1					
1902		8	9	5	4	2			
1903				4	10	14			
1904			16	11	2				
1905		7	5	12	4				
1906		3	21	4					
1907			11	14	3				
1908			3	12	5	7	2		
1909			9	5	9	1	4		
1910			7	12	8	1			
MARCH.									
1861			10	21					
1862				7	18	6			
1863				5	23	3			
1864			13	18					
1865				2	10	14	5		
1866			2	11	18				
1867				3	9	7	12		
1868			2	9	10	10			
1869			7	14	8	2			
1870				26	3	2			
1871				26	5				
1872		5	24	2					
1873			16	11	4				
1874			7	16	8				
1875				5	21	5			
1876			11	11	8	1			
1877		1	7	7	13	3			
1878			7	18	6				
1879				11	20				
1880				15	9	7			
1881				26	5				
1882				10	15	6			
1883				13	18				
1884			3	5	8	15			
1885		4	19	8					

TABLE 1.—*Number of days during each month and year when the river reading at Cincinnati, Ohio, was between the heights indicated, 1861 to 1910*—Continued.

Years.	0 to 4.9 feet.	5 to 9.9 feet.	10 to 19.9 feet.	20 to 29.9 feet.	30 to 39.9 feet.	40 to 49.9 feet.	50 to 59.9 feet.	60 to 69.9 feet.	70 to 79.9 feet.
MARCH—continued.	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*
1886			18	7	5	1			
1887			12	4	8	4	3		
1888			13	12	6				
1889			14	17					
1890				3	4	12	12		
1891					21	10			
1892			4	19	8				
1893			2	22	7				
1894			8	23					
1895			3	17	11				
1896			17	3	11				
1897					17	12	2		
1898			13	6	2	3	5	2	
1899				5	13	6	7		
1900			1	16	14				
1901		7	2	15	7				
1902			4	4	8	11	4		
1903				3	9	11	8		
1904			1	11	5	14			
1905			3	12	5	11			
1906			6	13	11	1			
1907				14	2	4	7	4	
1908				2	10	13	6		
1909			6	8	9	6	2		
1910			12	4	3	9	3		
APRIL.									
1861			5	12	6	7			
1862				9	6	9	6		
1863			12	15	3				
1864			1	22	7				
1865			5	8	11	6			
1866			2	19	9				
1867				25	5				
1868			4	12	12	2			
1869				20	4	6			
1870				10	7	13			
1871			18	12					
1872		4	8	3	10	5			
1873			4	11	15				
1874			4	6	14	6			
1875			11	12	7				
1876			6	19	4	1			
1877			9	17	4				
1878			28	2					
1879			15	10	5				
1880			13	12	2	3			
1881				18	9	3			
1882			22	8					
1883				8	13	9			
1884			9	13	8				
1885		1	5	14	10				
1886			8	4	2	4	12		
1887			17	4	4	5			
1888			11	12	7				
1889			22	8					
1890			1	12	16	1			
1891			5	8	11	6			
1892				16	8	6			
1893			5	17	7	1			
1894			15	15					
1895			7	14	9				
1896			13	8	3	6			
1897			5	14	11				
1898			6	17	2	2	3		
1899			10	12	4	2	2		
1900			23	7					
1901				8	12	2	8		
1902			8	14	5	3			
1903				11	14	5			
1904			11	8	6	5			
1905			18	11	1				
1906			6	15	3	5	1		
1907				29	1				
1908				10	11	5	4		
1909			4	21	5				
1910			24	6					

TABLE 1.—*Number of days during each month and year when the river reading at Cincinnati, Ohio, was between the heights indicated, 1861 to 1910*—Continued.

Years.	0 to 4.9 feet.	5 to 9.9 feet.	10 to 19.9 feet.	20 to 29.9 feet.	30 to 39.9 feet.	40 to 49.9 feet.	50 to 59.9 feet.	60 to 69.9 feet.	70 to 79.9 feet.
MAY.	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*
1861			10	14	7				
1862			22	7	2				
1863		4	16	11					
1864			15	10	6				
1865			5	9	9	6	2		
1866		5	22	4					
1867			11	17	3				
1868			6	10	13	2			
1869			12	14	5				
1870			28	3					
1871		3	11	10	6	1			
1872		8	23						
1873			10	12	9				
1874		7	12	5	3	4			
1875		6	21	4					
1876			23	8					
1877			21	10					
1878			9	21	1				
1879		10	21						
1880		12	11	4	2	2			
1881		2	21	8					
1882			1	13	13	4			
1883			17	14					
1884			25	6					
1885			30	1					
1886			17	6	8				
1887		3	10	14	4				
1888		5	26						
1889			25	6					
1890				10	14	7			
1891		20	11						
1892			5	20	6				
1893			1	10	9	9	2		
1894		2	22	4	3				
1895			31						
1896		10	21						
1897			11	16	4				
1898			2	29					
1899			20	11					
1900		6	25						
1901			12	9	7	2	1		
1902		4	27						
1903		12	16	3					
1904			17	9	5				
1905			15	7	3	6			
1906		7	22	2					
1907			10	20	1				
1908				19	6	6			
1909			9	11	4	7			
1910			19	12					
JUNE.									
1861		12	14	4					
1862			24	6					
1863	6	24							
1864		11	19						
1865			28	2					
1866	2	28							
1867		1	21	8					
1868		3	20	7					
1869			18	12					
1870		2	23	5					
1871		27	3						
1872		12	18						
1873		23	7						
1874		30							
1875		4	26						
1876		15	15						
1877		10	20						
1878		9	21						
1879		25	5						
1880		5	20	5					
1881		8	15	4	3				
1882			10	10	10				
1883			13	14	3				
1884			8	22					
1885		4	22	4					

TABLE 1.—*Number of days during each month and year when the river reading at Cincinnati, Ohio, was between the heights indicated, 1861 to 1910*—Continued.

Years.	0 to 4.9 feet.	5 to 9.9 feet.	10 to 19.9 feet.	20 to 29.9 feet.	30 to 39.9 feet.	40 to 49.9 feet.	50 to 59.9 feet.	60 to 69.9 feet.	70 to 79.9 feet.
JUNE—continued.	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*
1886		2	24	4					
1887		9	15	6					
1888		19	11						
1889			5	20	5				
1890			24	4	2				
1891			18	12					
1892			13	13	4				
1893			26	4					
1894		11	18	1					
1895	5	24	1						
1896		6	21	3					
1897		6	23	1					
1898		9	21						
1899			30						
1900		16	14						
1901			4	15	9	2			
1902		15	14	1					
1903			30						
1904		4	16	10					
1905			24	6					
1906		3	27						
1907			7	13	7	3			
1908		4	26						
1909			16	14					
1910			11	17	2				
JULY.									
1861		31							
1862		8	23						
1863		24	7						
1864	18	13							
1865		9	21	1					
1866		18	10	3					
1867		28	3						
1868		31							
1869			16	15					
1870		17	14						
1871		31							
1872		11	20						
1873		6	23	2					
1874	10	19	2						
1875			13	4	14				
1876		8	23						
1877		11	20						
1878		22	9						
1879	8	23							
1880		14	17						
1881		25	6						
1882		2	18	11					
1883		2	29						
1884	1	17	13						
1885	2	27	2						
1886		6	21	4					
1887	8	23							
1888		12	12	5	2				
1889			21	10					
1890		18	13						
1891		3	28						
1892		10	21						
1893		21	10						
1894	15	16							
1895	4	24	3						
1896		1	14	10	4	2			
1897		6	19	6					
1898		25	6						
1899		26	5						
1900		22	9						
1901		4	25	2					
1902			16	15					
1903		2	29						
1904		8	19	4					
1905			28	3					
1906		17	14						
1907			20	11					
1908		19	12						
1909		9	21	1					
1910		5	20	6					

TABLE 1.—*Number of days during each month and year when the river reading at Cincinnati, Ohio, was between the heights indicated, 1861 to 1910*—Continued.

Years.	0 to 4.9 feet.	5 to 9.9 feet.	10 to 19.9 feet.	20 to 29.9 feet.	30 to 39.9 feet.	40 to 49.9 feet.	50 to 59.9 feet.	60 to 69.9 feet.	70 to 79.9 feet.
AUGUST.	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*
1861		11	20						
1862	15	16							
1863	5	26							
1864	18	3	10						
1865		13	18						
1866	2	20	9						
1867	1	30							
1868		21	10						
1869		22	9						
1870		9	22						
1871	12	19							
1872		23	8						
1873		12	19						
1874		24	7						
1875		1	16	3	2	4	5		
1876		18	13						
1877	17	14							
1878		17	14						
1879		18	13						
1880		21	10						
1881	13	18							
1882		11	19	1					
1883	1	20	10						
1884	9	18	4						
1885		3	28						
1886		14	17						
1887	19	12							
1888		20	5	3	3				
1889		10	21						
1890		21	8	2					
1891		12	19						
1892		28	3						
1893	16	15							
1894	30	1							
1895		31							
1896			21	3	5	2			
1897		20	11						
1898			18	8	5				
1899	5	19	7						
1900	2	24	5						
1901		14	17						
1902		18	13						
1903		31							
1904		31							
1905		3	28						
1906		5	24	2					
1907		5	22	4					
1908		24	7						
1909		19	12						
1910	17	14							
SEPTEMBER.									
1861		22	7	1					
1862	30								
1863	30								
1864		3	27						
1865		8	18	4					
1866		7	12	4	5	2			
1867	22	8							
1868		10	7	8	3	2			
1869		19	7	4					
1870	6	20	4						
1871	15	15							
1872	14	16							
1873	11	14	5						
1874	22	8							
1875	18	12							
1876		12	6	9	3				
1877	7	23							
1878		18	5	3	4				
1879	8	16	6						
1880	5	25							
1881	24	6							
1882			30						
1883	29	1							
1884	30								
1885		12	18						

TABLE 1.—*Number of days during each month and year when the river reading at Cincinnati, Ohio, was between the heights indicated, 1861 to 1910*—Continued.

Years.	0 to 4.9 feet.	5 to 9.9 feet.	10 to 19.9 feet.	20 to 29.9 feet.	30 to 39.9 feet.	40 to 49.9 feet.	50 to 59.9 feet.	60 to 69.9 feet.	70 to 79.9 feet.
SEPTEMBER—continued.	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*
1886	11	19							
1887	30								
1888		2	24	4					
1889		28	2						
1890			15	10	5				
1891		17	13						
1892	3	27							
1893	5	20	5						
1894	24	2	4						
1895	16	14							
1896		30							
1897	17	13							
1898		29	1						
1899	14	16							
1900	17	13							
1901		12	18						
1902	27	3							
1903		22	8						
1904	18	12							
1905		14	16						
1906		16	14						
1907		1	29						
1908	25	5							
1909		30							
1910	3	26	1						
OCTOBER.									
1861			17	9	3	2			
1862	31								
1863	25	6							
1864		9	18	4					
1865		25	6						
1866		5	17	6	3				
1867	31								
1868		20	7	3	1				
1869		24	7						
1870	6	25							
1871	31								
1872	24	7							
1873	23	1	3	4					
1874	16	15							
1875		31							
1876	1	16	14						
1877	15	16							
1878	16	10	5						
1879	31								
1880	20	11							
1881	26	5							
1882		21	10						
1883		24	7						
1884	28	3							
1885	11	6	14						
1886	17	14							
1887	31								
1888		11	5	11	4				
1889		24	7						
1890			15	12	4				
1891	18	13							
1892	28	3							
1893		15	16						
1894	23	8							
1895	31								
1896		2	25	4					
1897	31								
1898	4	18	4	5					
1899	31								
1900	27	3	1						
1901	3	28							
1902	3	24	4						
1903	10	17	4						
1904	31								
1905		19	11	1					
1906			31						
1907		18	13						
1908	27	4							
1909	15	15	1						
1910	7	17	7						

TABLE 1.—*Number of days during each month and year when the river reading at Cincinnati, Ohio, was between the heights indicated, 1861 to 1910*—Continued.

Years.	0 to 4.9 feet.	5 to 9.9 feet.	10 to 19.9 feet.	20 to 29.9 feet.	30 to 39.9 feet.	40 to 49.9 feet.	50 to 59.9 feet.	60 to 69.9 feet.	70 to 79.9 feet.
NOVEMBER.	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*
1861	.....	.....	13	16	1	.....	.....	.....	.....
1862	19	8	3	.....	.....	.....	.....	.....	.....
1863	.....	22	8	.....	.....	.....	.....	.....	.....
1864	.....	2	8	20	.....	.....	.....	.....	.....
1865	.....	16	14	.....	.....	.....	.....	.....	.....
1866	.....	1	12	17	.....	.....	.....	.....	.....
1867	11	19	.....	.....	.....	.....	.....	.....	.....
1868	.....	5	25	.....	.....	.....	.....	.....	.....
1869	.....	23	7	.....	.....	.....	.....	.....	.....
1870	.....	25	5	.....	.....	.....	.....	.....	.....
1871	20	4	6	.....	.....	.....	.....	.....	.....
1872	.....	17	13	.....	.....	.....	.....	.....	.....
1873	.....	4	18	8	.....	.....	.....	.....	.....
1874	26	1	3	.....	.....	.....	.....	.....	.....
1875	.....	6	19	5	.....	.....	.....	.....	.....
1876	.....	8	22	.....	.....	.....	.....	.....	.....
1877	.....	16	10	1	3	.....	.....	.....	.....
1878	.....	4	21	3	2	.....	.....	.....	.....
1879	20	5	5	.....	.....	.....	.....	.....	.....
1880	.....	14	16	.....	.....	.....	.....	.....	.....
1881	.....	6	18	6	.....	.....	.....	.....	.....
1882	.....	30	.....	.....	.....	.....	.....	.....	.....
1883	.....	.....	26	4	.....	.....	.....	.....	.....
1884	24	6	.....	.....	.....	.....	.....	.....	.....
1885	.....	.....	29	1	.....	.....	.....	.....	.....
1886	13	4	5	7	1	.....	.....	.....	.....
1887	28	2	.....	.....	.....	.....	.....	.....	.....
1888	.....	.....	3	17	10	.....	.....	.....	.....
1889	.....	.....	11	10	9	.....	.....	.....	.....
1890	.....	.....	8	18	4	.....	.....	.....	.....
1891	2	19	5	4	.....	.....	.....	.....	.....
1892	11	19	.....	.....	.....	.....	.....	.....	.....
1893	.....	18	12	.....	.....	.....	.....	.....	.....
1894	7	23	.....	.....	.....	.....	.....	.....	.....
1895	26	4	.....	.....	.....	.....	.....	.....	.....
1896	.....	1	27	2	.....	.....	.....	.....	.....
1897	8	11	11	.....	.....	.....	.....	.....	.....
1898	.....	.....	22	8	.....	.....	.....	.....	.....
1899	8	22	.....	.....	.....	.....	.....	.....	.....
1900	6	17	3	1	3	.....	.....	.....	.....
1901	20	9	1	.....	.....	.....	.....	.....	.....
1902	3	24	3	.....	.....	.....	.....	.....	.....
1903	11	12	7	.....	.....	.....	.....	.....	.....
1904	25	5	.....	.....	.....	.....	.....	.....	.....
1905	.....	.....	29	1	.....	.....	.....	.....	.....
1906	.....	8	13	5	4	.....	.....	.....	.....
1907	.....	2	17	11	.....	.....	.....	.....	.....
1908	21	9	.....	.....	.....	.....	.....	.....	.....
1909	.....	29	1	.....	.....	.....	.....	.....	.....
1910	4	26	.....	.....	.....	.....	.....	.....	.....
DECEMBER.									
1861	.....	.....	22	5	4	.....	.....	.....	.....
1862	.....	23	8	.....	.....	.....	.....	.....	.....
1863	.....	6	19	6	.....	.....	.....	.....	.....
1864	.....	.....	12	11	3	5	.....	.....	.....
1865	.....	11	10	1	7	2	.....	.....	.....
1866	.....	.....	3	19	9	.....	.....	.....	.....
1867	8	7	10	4	2	.....	.....	.....	.....
1868	.....	.....	18	13	.....	.....	.....	.....	.....
1869	.....	.....	8	12	11	.....	.....	.....	.....
1870	.....	1	30	.....	.....	.....	.....	.....	.....
1871	1	24	6	.....	.....	.....	.....	.....	.....
1872	.....	19	11	1	.....	.....	.....	.....	.....
1873	.....	.....	5	14	8	4	.....	.....	.....
1874	.....	3	27	1	.....	.....	.....	.....	.....
1875	.....	.....	10	16	1	4	.....	.....	.....
1876	.....	7	24	.....	.....	.....	.....	.....	.....
1877	.....	.....	25	6	.....	.....	.....	.....	.....
1878	.....	.....	6	11	11	3	.....	.....	.....
1879	.....	7	15	2	5	2	.....	.....	.....
1880	.....	3	18	3	7	.....	.....	.....	.....
1881	.....	.....	15	1	13	2	.....	.....	.....
1882	.....	6	25	.....	.....	.....	.....	.....	.....
1883	.....	.....	23	1	1	6	.....	.....	.....
1884	4	8	17	2	.....	.....	.....	.....	.....
1885	.....	.....	22	8	1	.....	.....	.....	.....

TABLE 1.—*Number of days during each month and year when the river reading at Cincinnati, Ohio, was between the heights indicated, 1861 to 1910*—Continued.

Years.	0 to 4.9 feet.	5 to 9.9 feet.	10 to 19.9 feet.	20 to 29.9 feet.	30 to 39.9 feet.	40 to 49.9 feet.	50 to 59.9 feet.	60 to 69.9 feet.	70 to 79.9 feet.
DECEMBER—continued.	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*
1886			15	16					
1887	4	27							
1888			26	5					
1889			4	27					
1890			24	5	2				
1891			21	10					
1892		18	13						
1893		2	22	7					
1894		11	20						
1895	1	22	7	1					
1896			16	15					
1897			23	8					
1898			22	6	3				
1899		15	9	7					
1900		9	8	10	3	1			
1901			20	4	7				
1902			12	10	2	7			
1903		21	9	1					
1904	24	6	1						
1905			7	16	7	1			
1906			13	9	9				
1907			15	12	4				
1908	12	14	5						
1909		23	8						
1910		16	13	2					

TABLE NO. 2.

This table gives the average precipitation for the watershed for each month, together with the averages for each 10 years, for each 25 years, and for the whole 50 years.

TABLE 2.—*Average precipitation in the Ohio watershed above Cincinnati, 1861 to 1910, inclusive.*

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	In.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
1861	2.5	2.0	2.3	4.5	5.0	3.5	3.5	4.5	3.3	3.6	4.0	1.2	39.9
1862	5.4	3.1	4.6	5.6	3.2	3.3	3.6	2.2	1.1	1.7	2.9	3.1	39.8
1863	6.2	3.5	3.6	2.0	2.4	2.7	2.4	2.9	2.1	3.7	2.5	3.2	37.2
1864	1.8	1.4	2.6	2.5	3.2	2.4	1.5	5.4	4.9	2.4	4.4	3.7	36.2
1865	2.6	2.4	5.0	4.5	7.3	4.3	5.8	3.8	5.9	1.5	0.9	4.8	48.8
1866	3.5	2.5	3.7	2.7	1.3	4.5	5.5	3.9	10.1	3.2	4.1	2.2	47.2
1867	2.4	5.0	5.0	2.7	4.0	3.2	3.9	2.8	0.8	3.0	2.1	4.2	39.1
1868	3.1	1.2	5.3	3.6	5.5	4.8	3.1	4.8	7.6	1.5	2.0	2.2	44.7
1869	2.9	2.9	4.2	2.9	4.6	3.9	4.5	2.2	4.0	2.0	3.6	3.1	40.8
1870	6.2	3.1	4.2	2.5	1.9	3.7	4.4	3.1	1.4	2.9	1.8	2.3	37.5
1871	2.1	2.7	2.6	2.0	2.8	3.3	3.0	4.4	1.3	1.8	2.7	2.6	31.3
1872	0.9	1.9	1.5	4.7	2.9	2.7	6.2	3.1	1.6	2.5	1.0	2.5	31.5
1873	2.5	3.6	3.1	2.9	3.8	3.5	5.7	3.8	2.3	4.5	2.1	5.0	42.8
1874	4.2	4.1	3.5	5.2	1.3	2.8	5.1	2.4	2.7	0.5	3.9	3.5	39.2
1875	1.7	1.8	4.0	1.7	3.2	5.0	8.9	3.1	2.1	2.6	4.3	3.6	42.0
1876	6.1	2.5	3.8	2.7	2.6	3.5	7.0	3.5	5.6	2.4	2.4	1.4	43.5
1877	2.9	0.7	5.3	2.7	2.3	5.6	4.0	1.8	2.2	1.9	3.5	2.4	35.3
1878	3.0	1.7	3.0	2.4	2.6	3.9	4.2	3.2	4.2	2.7	3.2	3.6	37.7
1879	3.0	2.8	4.3	1.0	2.2	4.3	4.4	6.1	2.8	0.8	3.2	4.7	39.6
1880	4.3	4.2	3.8	5.5	3.2	4.8	2.9	4.6	2.6	2.3	3.0	3.2	44.4
1881	2.9	3.4	3.8	2.4	2.2	4.4	4.1	1.6	2.5	4.7	3.6	5.0	40.6
1882	5.9	5.3	4.8	2.9	7.7	5.5	3.0	5.0	3.3	1.8	1.6	1.9	48.7
1883	2.9	7.3	2.9	4.2	5.0	4.6	3.7	1.6	2.3	5.4	3.5	4.5	47.9
1884	3.8	6.1	4.1	2.5	4.0	2.8	3.0	1.5	3.9	1.4	1.4	4.1	38.6
1885	5.3	2.3	1.0	3.6	3.7	3.6	2.3	5.8	2.6	3.6	2.6	1.8	38.2
1886	3.7	1.8	3.3	3.0	5.0	4.2	3.4	3.4	3.6	1.1	4.6	2.5	39.6
1887	2.7	7.3	2.1	5.1	3.6	3.5	3.5	2.4	2.5	0.5	2.6	2.7	38.5
1888	4.7	1.8	4.3	2.1	3.7	2.5	5.2	8.1	2.1	4.1	4.5	1.5	44.6
1889	3.8	1.6	1.3	2.0	3.5	3.9	5.7	1.3	4.0	2.1	4.7	2.5	36.4

TABLE 2.—*Average precipitation in the Ohio watershed above Cincinnati, 1861 to 1910, inclusive*—Continued.

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	In.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
1890	5.3	5.9	6.4	3.3	4.9	4.5	2.3	5.1	5.6	3.9	2.6	3.5	53.3
1891	3.4	4.9	5.1	2.2	2.2	4.9	4.8	3.1	1.8	1.6	4.8	2.4	41.2
1892	2.4	3.1	3.0	4.3	5.2	4.8	4.2	3.0	3.0	0.5	2.6	2.0	38.1
1893	2.9	5.4	2.0	6.5	4.4	4.0	3.0	2.0	2.2	4.5	2.3	2.6	41.8
1894	2.5	3.7	2.2	3.0	3.6	3.0	1.9	2.8	2.9	1.5	1.9	3.4	32.4
1895	5.0	0.7	2.4	2.4	2.1	2.8	2.2	2.9	1.1	1.1	3.8	3.6	30.1
1896	1.6	2.6	4.1	1.9	3.1	4.3	9.1	3.7	4.8	1.8	3.1	1.7	41.8
1897	2.1	5.3	6.0	4.0	3.9	3.1	5.5	2.4	1.0	0.4	6.3	3.4	43.4
1898	6.7	2.1	7.2	2.3	4.5	3.9	4.2	4.2	2.7	4.0	3.1	2.7	47.6
1899	4.1	2.7	5.7	1.8	4.2	3.4	3.6	2.6	2.7	2.0	1.9	3.0	37.7
1900	2.5	3.2	2.2	1.8	2.5	2.7	3.9	3.9	1.3	1.6	5.0	1.7	32.3
1901	1.6	1.1	2.6	4.3	3.7	4.7	2.4	3.5	2.3	0.6	1.4	4.0	32.2
1902	2.4	1.1	3.1	2.2	3.2	6.8	3.1	1.7	3.4	2.4	2.7	4.8	36.9
1903	2.3	5.7	4.2	3.4	2.6	3.9	3.2	2.1	1.2	2.2	2.1	1.8	34.7
1904	2.6	2.1	5.9	2.9	3.1	3.2	2.6	2.2	1.4	1.1	0.3	3.3	30.7
1905	2.0	1.7	3.5	3.2	6.0	4.4	3.4	4.6	3.2	4.7	2.7	2.8	42.2
1906	2.5	1.6	5.3	1.6	2.3	4.1	5.2	4.5	3.3	2.1	2.9	3.9	39.3
1907	7.4	1.2	5.8	2.8	3.3	4.6	6.1	2.9	2.6	2.2	2.1	2.9	43.9
1908	1.6	4.6	6.0	4.1	4.7	2.3	3.6	2.8	0.4	1.1	1.1	2.0	34.3
1909	1.2	5.9	3.0	4.6	4.2	6.0	4.1	2.8	2.0	2.3	1.6	2.6	40.3
1910	4.8	4.3	0.3	2.9	4.3	3.2	3.7	2.1	4.6	3.7	1.4	2.7	38.0
Mean	3.40	3.18	3.78	3.15	3.63	3.91	4.11	3.34	2.98	2.35	2.85	3.00	39.68
1861–1870	3.66	2.71	4.05	3.35	3.84	3.63	3.82	3.56	4.12	2.55	2.83	3.00	41.12
1871–1880	3.07	2.60	3.49	3.08	2.69	3.94	5.14	3.60	2.74	2.20	2.93	3.25	38.73
1881–1890	4.10	4.28	3.40	3.11	4.33	3.95	3.62	3.58	3.24	2.86	3.17	3.00	42.64
1891–1900	3.32	3.37	3.99	3.02	3.57	3.69	4.24	3.06	2.35	1.90	3.48	2.65	38.64
1901–1910	2.84	2.93	3.97	3.20	3.74	4.32	3.74	2.92	2.44	2.24	1.83	3.08	37.25
1861–1885	3.52	3.10	3.68	3.20	3.52	3.86	4.23	3.48	3.33	2.58	2.81	3.19	40.50
1886–1910	3.27	3.26	3.88	3.11	3.75	3.95	4.00	3.20	2.63	2.12	2.88	2.80	38.85

TABLE NO. 3.

This table shows the departure of the monthly precipitation from the normal for each month and the departure of each 10-year and each 25-year average from the normal.

TABLE 3.—*Departure of monthly precipitation from normals, Ohio watershed above Cincinnati, Ohio, 1861 to 1910, inclusive.*

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	In.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
1861	−0.9	−1.2	−1.5	+1.3	+1.4	−0.4	−0.6	+1.2	+0.3	+1.2	+1.2	−1.8	+ 0.2
1862	+2.0	−0.1	+0.8	+2.4	−0.4	−0.6	−0.5	−1.1	−1.9	−0.7	+0.1	+0.1	+ 0.1
1863	+2.8	+0.3	−0.2	−1.2	−1.2	−1.2	−1.7	−0.4	−0.9	+1.3	−0.3	+0.2	− 2.5
1864	−1.6	−1.8	−1.2	−0.7	−0.4	−1.5	−2.6	+2.1	+1.9	±0.0	+1.6	+0.7	− 3.5
1865	−0.8	−0.8	+1.2	+1.3	+3.7	+0.4	+1.7	+0.5	+2.9	−0.9	−1.9	+1.8	+ 9.1
1866	+0.1	−0.7	−0.1	−0.5	−2.3	+0.6	+1.4	+0.6	+7.1	+0.8	−1.3	−0.8	+ 7.5
1867	−1.0	+1.8	+1.2	−0.5	+0.4	−0.7	−0.2	−0.5	−2.2	+0.6	−0.7	+1.2	− 0.6
1868	−0.3	−2.0	+1.7	+0.4	+1.9	+0.9	−1.0	+1.5	+4.6	−0.9	−0.8	−0.8	+ 5.0
1869	−0.5	−0.3	+0.4	−0.3	+1.0	±0.0	+0.4	−1.1	+1.0	−0.4	+0.8	+0.1	+ 1.1
1870	+2.8	−0.1	+0.4	−0.7	−1.7	−0.2	+0.3	−0.2	−1.6	+0.5	+1.0	−0.7	− 2.2
1871	−1.3	−0.5	−1.2	−1.2	−0.8	−0.6	−1.1	+1.1	−1.7	−0.6	−0.1	−0.4	− 8.4
1872	−2.5	−1.3	−2.3	+1.5	−0.7	−1.2	+2.1	−0.2	−1.4	+0.1	−1.8	−0.5	− 8.2
1873	−0.9	+0.4	−0.7	−0.3	+0.2	−0.4	+1.6	+0.5	−0.7	+2.1	−1.7	+2.0	+ 3.1
1874	+0.8	+0.9	−0.3	+2.0	−2.3	−1.1	+1.0	−0.9	−0.3	−1.9	+1.1	+0.5	− 0.5
1875	−1.7	−1.4	+0.2	−1.5	−0.4	+1.1	+4.8	−0.2	−0.9	+0.2	+1.5	+0.6	+ 2.3
1876	+2.7	−0.7	±0.0	−0.5	−1.0	−0.4	+2.9	+0.2	+2.6	±0.0	−0.4	−1.6	+ 3.8
1877	−0.5	−2.5	+1.7	−0.5	−1.3	+1.7	−0.1	−1.5	−0.8	−0.5	+0.7	−0.6	− 4.4
1878	−0.4	−1.5	−0.8	−0.8	−1.0	±0.0	+0.1	−0.1	+1.2	+0.3	+0.4	+0.6	− 2.0
1879	−0.4	−0.4	+0.5	−2.2	−1.4	+0.4	+0.3	+2.8	−0.2	−1.6	+0.4	+1.7	− 0.1
1880	+0.9	+1.0	±0.0	+2.3	−0.4	+0.9	−1.2	+1.3	−0.4	−0.1	+0.2	+0.2	+ 4.7
1881	−0.5	+0.2	±0.0	−0.8	−1.4	+0.5	±0.0	−1.7	−0.5	+2.3	+0.8	+2.0	+ 0.9
1882	+2.5	+2.1	+1.0	−0.3	+4.1	+1.6	−1.1	+1.7	+0.3	−0.6	−1.2	−1.1	+ 9.2
1883	−0.5	+4.1	−0.9	+1.0	+1.4	+0.7	−0.4	−1.7	−0.7	+3.0	+0.7	+1.5	+ 8.0

TABLE 3.—*Departure of monthly precipitation from normals, Ohio watershed above Cincinnati, Ohio, 1861 to 1910, inclusive*—Continued.

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	In.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
1884	+0.4	+2.9	+0.3	−0.7	+0.4	−1.1	−1.1	−1.8	+0.9	+1.0	−1.4	+1.1	− 1.1
1885	+1.9	−0.9	−2.8	+0.4	+0.1	−0.3	−1.8	+2.5	−0.4	−1.2	−0.2	−1.2	− 1.5
1886	+0.3	−1.4	−0.5	−0.2	+1.4	+0.3	−0.7	+0.1	+0.6	−1.3	+1.8	−0.5	− 0.1
1887	−0.7	+4.1	−1.7	+1.9	±0.0	−0.4	−0.6	−0.9	−0.5	−1.9	−0.2	−0.3	− 1.2
1888	+1.3	−1.4	+0.5	−1.1	+0.1	−1.4	+1.1	+4.8	−0.9	+1.7	+1.7	−1.5	+ 4.9
1889	+0.4	−1.6	−2.5	−1.2	−0.1	±0.0	+1.6	−2.0	+1.0	−1.3	+1.9	−0.5	− 3.3
1890	+1.9	+2.7	+2.6	+0.1	+1.3	+0.6	−1.8	+1.8	+2.6	+1.5	−0.2	+0.5	+13.6
1891	±0.0	+1.7	+1.3	−1.0	−1.4	+1.0	+0.7	−0.2	−1.2	−0.8	+2.0	−0.6	+ 1.5
1892	−1.0	−0.1	−0.8	+1.1	+1.6	+0.9	+0.1	−0.3	±0.0	−1.9	−0.2	−1.0	− 1.6
1893	−0.5	+2.2	−1.8	+3.3	+0.8	+0.1	−1.1	−1.3	−0.8	+2.1	−0.5	−0.4	+ 2.1
1894	−0.9	+0.5	−1.6	−0.2	±0.0	−0.9	−2.2	−0.5	−6.1	−0.9	−0.9	+0.4	− 7.3
1895	+1.6	−2.5	−1.4	−0.8	−1.4	−1.1	−1.9	−0.4	−1.9	−1.3	+1.0	+0.6	− 9.6
1896	−1.8	−0.6	+0.3	−1.3	−0.5	+0.4	+5.0	+0.4	+1.8	−0.6	+0.3	−1.3	+ 2.1
1897	−1.3	+2.1	+2.2	+0.8	+0.3	−0.8	+1.4	−0.9	−2.0	−2.0	+3.5	+0.4	+ 3.7
1898	+3.3	−1.1	+3.4	−0.9	+0.9	±0.0	+0.1	+0.9	−0.3	+1.6	+0.3	−0.3	+ 7.9
1899	+0.7	−0.5	+1.9	−1.4	+0.6	−0.5	−0.5	−0.7	−0.3	−0.4	+0.9	±0.0	− 2.0
1900	−0.9	±0.0	−1.6	−1.4	−1.1	−1.2	−0.3	+0.6	−1.7	−0.8	+2.2	−1.3	− 7.4
1901	−1.8	−2.1	−1.1	+1.1	+0.1	+0.8	−1.7	+0.2	−0.7	−1.8	−1.4	+1.0	− 7.5
1902	−1.0	−2.1	−0.7	−1.0	−0.4	+2.9	−1.0	−1.6	+0.4	±0.0	−0.1	+1.8	− 2.8
1903	−1.1	+2.5	+0.4	+0.2	−1.0	±0.0	−0.9	−1.2	−1.8	−0.2	−0.7	−1.2	− 5.0
1904	−0.8	−1.1	+2.1	−0.3	−0.5	−0.7	−1.5	−1.1	−1.6	−1.3	−2.5	+0.3	− 9.0
1905	−1.4	−1.5	−0.3	±0.0	+2.4	+0.5	−0.7	+1.3	+0.2	+2.3	−0.1	−0.2	+ 2.5
1906	−0.9	−1.6	+1.5	−1.6	−1.3	+0.2	+1.1	+1.2	+0.3	−0.3	+0.1	+0.9	− 0.4
1907	+4.0	−2.0	+2.0	−0.4	−0.3	+0.7	+2.0	−0.4	−0.4	−0.2	−0.7	−0.1	+ 4.2
1908	−1.8	+1.4	+2.2	+0.9	+1.1	−1.6	−0.5	−0.5	−2.6	−1.3	−1.7	−1.0	− 5.4
1909	−2.2	+2.7	−0.8	+1.4	+0.6	+2.1	±0.0	−0.5	−1.0	−0.1	−1.2	−0.4	+ 0.6
1910	+1.4	+1.1	−3.5	−0.3	+0.7	−0.7	−0.4	−1.2	+1.6	+1.3	−1.4	−0.3	− 1.7
1861–1870	+0.3	−0.5	+0.2	+0.2	+0.2	−0.3	−0.3	+0.3	+1.1	+0.2	±0.0	±0.0	+ 1.5
1871–1880	−0.3	−0.6	−0.3	−0.1	−0.9	±0.0	+1.0	+0.3	−0.3	−0.2	+0.1	+0.2	− 1.3
1881–1890	+0.7	+1.1	−0.4	−0.1	+0.7	+0.1	−0.5	+0.3	+0.2	+0.5	+0.4	±0.0	+ 3.0
1891–1900	−0.1	+0.2	+0.2	−0.2	±0.0	−0.2	+0.1	−0.2	−0.6	−0.5	+0.7	−0.4	− 1.0
1901–1910	−0.6	−0.3	+0.2	±0.0	+0.1	+0.4	−0.4	−0.4	−0.6	−0.2	−1.0	+0.1	− 2.7
1861–1885	+0.1	−0.1	−0.1	±0.0	−0.1	±0.0	+0.1	+0.2	+0.4	+0.2	±0.0	+0.2	+ 0.8
1886–1910	−0.1	+0.1	+0.1	−0.1	+0.2	+0.1	−0.1	−0.1	−0.4	−0.3	+0.1	−0.2	− 0.8

TABLE NO. 4.

The number of days that the river stages were between each 5 or 10 feet for each month and the year for each 10-year period is shown in Table 5, together with the totals for the 50 years and the means for each 10-year period. The yearly averages can be obtained by dividing the 10-year averages by 10.

If it is true that the cutting away of the forests has increased flood conditions and intensified low-water periods, it seems to the writer that there would be a regular increase in the low-water days in the months of July, August, and September, and that this increase would appear in the 10-year periods in the table. On the contrary, there were only 64 days from 1901 to 1910, inclusive, when the river was between 5 and 10 feet during the month of July, as compared with 179 days from 1861 to 1870, inclusive. In October there were only 96 days in the 10 years from 1901 to 1910, inclusive, when the river was below 5 feet, as compared with 177 days in the 10 years from 1871 to 1880, inclusive. The high-water days should show a regular increase also during the months from January to April, inclusive, but such is not the case.

TABLE 4.—*Total number of days in each month with river readings between values indicated at Cincinnati, 10-year periods, 1861 to 1910, inclusive.*

0 TO 4.9 FEET.

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
	Days.	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*
1861–1870	0	0	0	0	0	8	18	41	88	93	30	8	286
1871–1880	0	0	0	0	0	0	18	29	100	177	66	1	391
1881–1890	0	0	0	0	0	0	11	42	124	113	65	8	363
1891–1900	0	0	0	0	0	5	19	53	96	193	68	1	435
1901–1910	0	0	0	0	0	0	0	17	73	96	84	36	306

5 TO 9.9 FEET.

1861–1870	6	10	0	0	9	81	179	171	97	114	121	48	836
1871–1880	34	14	6	4	46	160	145	167	159	107	79	63	984
1881–1890	9	7	4	1	10	50	132	147	68	108	48	41	625
1891–1900	29	0	0	0	38	72	154	150	181	62	134	79	899
1901–1910	14	22	7	0	23	26	64	164	141	142	124	80	807

10 TO 19.9 FEET.

1861–1870	124	86	34	29	147	167	94	98	82	72	95	140	1,168
1871–1880	102	93	72	116	162	135	127	100	22	22	133	147	1,231
1881–1890	89	49	79	95	172	161	135	112	89	58	100	171	1,310
1891–1900	128	81	48	89	149	185	115	84	23	46	80	161	1,189
1901–1910	137	104	34	71	147	175	204	123	86	71	71	103	1,326

20 TO 29.9 FEET.

1861–1870	90	99	116	152	99	44	19	0	21	22	53	71	786
1871–1880	96	106	122	104	74	5	6	3	12	4	17	54	603
1881–1890	119	67	105	101	78	66	30	6	14	23	63	65	737
1891–1900	74	82	111	128	90	34	16	11	0	9	15	64	634
1901–1910	86	80	86	133	92	76	42	6	0	1	17	54	673

30 TO 39.9 FEET.

1861–1870	64	59	99	70	45	0	0	0	8	7	1	36	389
1871–1880	50	43	94	61	21	0	14	2	7	0	5	32	329
1881–1890	56	45	69	69	39	23	2	3	5	8	24	17	360
1891–1900	42	67	104	55	22	4	4	10	0	0	3	6	317
1901–1910	40	45	69	58	26	18	0	0	0	0	4	29	289

40 TO 49.9 FEET.

1861–1870	14	21	44	43	8	0	0	0	4	2	0	7	143
1871–1880	23	23	16	15	7	0	0	4	0	0	0	13	101
1881–1890	37	55	38	22	11	0	0	0	0	0	0	8	171
1891–1900	32	30	31	23	9	0	2	2	0	0	0	1	130
1901–1910	22	25	80	25	21	5	0	0	0	0	0	8	186

50 TO 59.9 FEET.

1861–1870	12	7	17	6	2	0	0	0	0	0	0	0	44
1871–1880	6	4	0	0	0	0	0	5	0	0	0	0	15
1881–1890	0	39	15	12	0	0	0	0	0	0	0	0	66
1891–1900	5	20	14	5	2	0	0	0	0	0	0	0	46
1901–1910	5	6	30	13	1	0	0	0	0	0	0	0	55

60 TO 69.9 FEET.

1861–1870	0	0	0	0	0	0	0	0	0	0	0	0	0
1871–1880	0	0	0	0	0	0	0	0	0	0	0	0	0
1881–1890	0	18	0	0	0	0	0	0	0	0	0	0	18
1891–1900	0	2	2	0	0	0	0	0	0	0	0	0	4
1901–1910	6	0	4	0	0	0	0	0	0	0	0	0	10

TABLE 4.—*Total number of days in each month with river readings between values indicated at Cincinnati, 10-year periods, 1861 to 1910, inclusive*—Continued.

70 TO 79.9 FEET.

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
	Days.	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*
1861–1870	0	0	0	0	0	0	0	0	0	0	0	0	0
1871–1880	0	0	0	0	0	0	0	0	0	0	0	0	0
1881–1890	0	2	0	0	0	0	0	0	0	0	0	0	2
1891–1900	0	0	0	0	0	0	0	0	0	0	0	0	0
1901–1910	0	0	0	0	0	0	0	0	0	0	0	0	0

Totals for 50 years and means for each 10-year period.

0 TO 4.9 FEET.

Sums	0	0	0	0	0	13	66	182	481	672	313	54	1,781
Means	0	0	0	0	0	3	13	36	96	134	63	11	356

5 TO 9.9 FEET.

Sums	92	53	17	5	126	389	674	799	646	533	506	309	4,149
Means	18	11	3	1	25	78	135	160	129	107	101	62	830

10 TO 19.9 FEET.

Sums	580	413	267	400	777	824	675	517	302	269	479	722	6,225
Means	116	83	53	80	155	165	135	103	60	54	96	144	1,244

20 TO 29.9 FEET.

Sums	464	434	540	619	433	235	113	26	47	59	165	308	3,433
Means	93	87	108	124	87	47	23	5	9	12	33	62	687

30 TO 39.9 FEET.

Sums	252	259	435	313	153	45	20	15	20	15	37	120	1,685
Means	50	52	85	63	31	9	4	3	4	3	7	24	337

40 TO 49.9 FEET.

Sums	128	154	209	128	56	5	2	6	4	2	0	37	731
Means	26	31	42	26	11	1	0	1	1	0	0	7	146

50 TO 59.9 FEET.

Sums	28	76	76	36	5	0	0	5	0	0	0	0	226
Means	6	15	15	7	1	0	0	1	0	0	0	0	45

60 TO 69.9 FEET.

Sums	6	20	6	0	0	0	0	0	0	0	0	0	32
Means	1	4	1	0	0	0	0	0	0	0	0	0	6

70 TO 79.9 FEET.

Sums	0	2	0	0	0	0	0	0	0	0	0	0	2
Means	0	0	0	0	0	0	0	0	0	0	0	0	0

Table No. 5.

This table shows the number of days the river at Cincinnati was between each 5 or 10 feet for each month and the year for the two 25-year periods, 1861 to 1885 and 1886 to 1910, all inclusive.

It will be seen that there was very little difference between the total number of flood days of the two periods during the months of January and February, while during the months of March and April the greater number occurred in the second period. It will also be seen that the low-water days were in excess in the first period during the months from June to September, inclusive, while during the second period the low-water days were in excess in November and December.

Flood conditions are not the products of precipitation extending over any considerable period of time, but are, as a rule, the results of abnormal precipitation within a comparatively short time, and there is therefore no direct relation between the average annual precipitation and the number of flood days and the intensity of flood conditions. On the other hand, low-water periods are usually the results of prolonged periods of deficient precipitation, and the relation between the two is therefore quite clearly marked.

Table 5.—*Total number of days in each month with river readings between values indicated at Cincinnati, 25-year periods, 1861 to 1910, inclusive.*

0.0 TO 4.9 FEET.

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
	Days.	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*
1861–1885	0	0	0	0	0	8	39	93	271	335	120	13	879
1886–1910	0	0	0	0	0	5	27	89	210	337	193	41	902

5 TO 9.9 FEET.

1861–1885	45	28	10	5	57	261	397	408	275	280	242	125	2,133
1886–1910	47	25	7	0	69	128	277	391	371	253	264	184	2,016

10 TO 19.9 FEET.

1861–1885	275	203	128	181	403	385	289	259	152	125	301	389	3,090
1886–1910	305	210	139	219	374	439	386	258	150	144	178	333	3,135

20 TO 29.9 FEET.

1861–1885	234	228	300	317	215	81	36	4	33	26	81	137	1,692
1886–1910	230	206	240	302	218	144	77	22	14	33	84	171	1,741

30 TO 39.9 FEET.

1861–1885	138	120	239	171	79	16	14	2	15	7	6	83	890
1886–1910	114	139	196	141	74	29	6	13	5	8	31	37	793

40 TO 49.9 FEET.

1861–1885	65	70	81	70	19	0	0	4	4	2	0	28	343
1886–1910	63	84	128	58	37	5	2	2	0	0	0	9	388

TABLE 5.—*Total number of days in each month with river readings between values indicated at Cincinnati, 25-year periods, 1861 to 1910, inclusive*—Continued.

50 TO 59.9 FEET.

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
	Days.	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*
1861–1885	18	37	17	6	2	0	0	5	0	0	0	0	85
1886–1910	10	39	59	30	3	0	0	0	0	0	0	0	141

60 TO 69.9 FEET.

1861–1885	0	18	0	0	0	0	0	0	0	0	0	0	18
1886–1910	6	2	6	0	0	0	0	0	0	0	0	0	14

70 TO 79.9 FEET.

1861–1885	0	2	0	0	0	0	0	0	0	0	0	0	2
1886–1910	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE NO. 6.

In this table is given the average precipitation and the average number of days the river at Cincinnati was above 50 feet, below 5 feet, and below 10 feet for each month and the year for each 10-year and each 25-year period.

TABLE 6.—*Average precipitation in the Ohio watershed above Cincinnati, and days with the river above 50 feet, below 5 feet, and below 10 feet at Cincinnati, 1861–1910, inclusive.*

1861 TO 1870, INCLUSIVE.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Rainfall (inches)	3.7	2.7	4.0	3.4	3.8	3.6	3.8	3.6	4.1	2.6	2.8	3.0	41.1
Days with river above 50 feet	12	7	17	6	2	0	0	0	0	0	0	0	44
Days with river below 5 feet	0	0	0	0	0	8	18	41	88	93	30	8	286
Days with river below 10 feet	6	10	0	0	9	89	197	212	185	207	151	56	1,122

1871 TO 1880, INCLUSIVE.

Rainfall (inches)	3.1	2.6	3.5	3.1	2.7	3.9	5.1	3.6	2.7	2.2	2.9	3.2	38.6
Days with river above 50 feet	6	4	0	0	0	0	0	5	0	0	0	0	15
Days with river below 5 feet	0	0	0	0	0	0	18	29	100	177	66	1	391
Days with river below 10 feet	34	14	6	4	46	160	163	196	259	284	145	64	1,375

1881 TO 1890, INCLUSIVE.

Rainfall (inches)	4.1	4.3	3.4	3.1	4.3	4.0	3.6	3.6	3.2	2.9	3.2	3.0	42.7
Days with river above 50 feet	0	59	15	12	0	0	0	0	0	0	0	0	86
Days with river below 5 feet	0	0	0	0	0	0	11	42	124	113	65	8	363
Days with river below 10 feet	9	7	4	1	10	50	143	189	192	221	113	49	988

1891 TO 1900, INCLUSIVE.

Rainfall (inches)	3.3	3.4	4.0	3.0	3.6	3.7	4.2	3.1	2.4	1.9	3.5	2.6	38.7
Days with river above 50 feet	5	22	16	5	2	0	0	0	0	0	0	0	50
Days with river below 5 feet	0	0	0	0	0	5	19	53	96	193	68	1	435
Days with river below 10 feet	29	0	0	0	38	77	173	203	277	255	202	78	1,332

TABLE 6.—*Average precipitation in the Ohio watershed above Cincinnati, and days with the river above 50 feet, below 5 feet, and below 10 feet at Cincinnati, 1861–1910, inclusive*—Continued.

1901 TO 1910, INCLUSIVE.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Rainfall (inches)	2.8	2.9	4.0	3.2	3.7	4.3	3.7	2.9	2.4	2.2	1.8	3.1	37.0
Days with river above 50 feet	11	6	34	13	1	0	0	0	0	0	0	0	65
Days with river below 5 feet	0	0	0	0	0	0	0	17	73	96	84	36	306
Days with river below 10 feet	14	22	7	0	23	26	64	181	214	238	208	116	1,113

1861 TO 1885, INCLUSIVE.

Rainfall (inches)	3.5	3.1	3.7	3.2	3.5	3.9	4.2	3.5	3.3	2.6	2.8	3.2	40.5
Days with river above 50 feet	18	57	17	6	2	0	0	5	0	0	0	0	105
Days with river below 5 feet	0	0	0	0	0	8	39	93	271	335	120	13	879
Days with river below 10 feet	45	28	10	5	57	269	436	501	546	615	362	138	3,012

1886 TO 1910, INCLUSIVE.

Rainfall (inches)	3.3	3.3	3.9	3.1	3.8	4.0	4.0	3.2	2.6	2.1	2.9	2.8	38.8
Days with river above 50 feet	16	41	65	30	3	0	0	0	0	0	0	0	155
Days with river below 5 feet	0	0	0	0	0	5	27	89	210	337	193	41	902
Days with river below 10 feet	47	25	7	0	69	133	306	480	581	590	457	215	2,910

TABLE NO. 7.

This table is supplementary to Table 6, and gives the departures from the normals for the same data as are shown in Table 6. In these tables we begin to observe the effect of precipitation upon river stages.

TABLE 7.—*Departures of precipitation and river-stage days from normals at Cincinnati for days above 50 feet, below 5 feet, and below 10 feet, 1861–1910.*

1861 TO 1870, INCLUSIVE.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Precipitation (inches)	+0.3	−0.5	+0.2	+0.2	+0.2	−0.3	−0.3	+0.3	+1.1	+0.2	0	0	+1.5
Days above 50 feet	+ 5	− 13	+ 1	− 2	+ 1	.....	.....	− 1	.....	.....	.....	.....	− 8
Days below 5 feet	.....	.....	.....	.....	.....	+ 5	+ 5	+ 5	− 8	− 39	− 33	− 3	− 70
Days below 10 feet	− 12	− 1	− 3	− 1	− 17	+ 9	+ 48	+ 16	− 45	− 34	− 13	− 17	− 65

1871 TO 1880, INCLUSIVE.

Precipitation (inches)	−0.3	−0.6	−0.3	−0.1	−0.9	0	+1.0	+0.3	−0.3	−0.2	+0.1	+0.2	−1.3
Days above 50 feet	− 1	− 16	− 16	− 8	− 1	.....	.....	0	.....	.....	.....	.....	− 37
Days below 5 feet	.....	.....	.....	.....	.....	− 3	+ 5	− 7	+ 4	+ 43	+ 3	− 10	+ 35
Days below 10 feet	+ 16	+ 3	+ 3	+ 3	+ 21	+ 80	+ 14	0	+ 34	+ 43	− 19	− 9	+188

1881 TO 1890, INCLUSIVE.

Precipitation (inches)	+0.7	+1.1	−0.4	−0.1	+0.7	+0.1	−0.5	+0.3	+0.2	+0.5	+0.4	0	+3.0
Days above 50 feet	− 7	+ 39	− 1	+ 4	− 1	.....	.....	− 1	.....	.....	.....	.....	+ 34
Days below 5 feet	.....	.....	.....	.....	.....	− 3	− 4	+ 6	+ 28	− 21	+ 2	− 3	+ 7
Days below 10 feet	− 9	− 4	+ 1	0	− 15	− 30	− 5	− 7	− 33	− 20	− 54	+ 24	−198

TABLE 7.—*Departures of precipitation and river-stage days from normals at Cincinnati for days above 50 feet, below 5 feet, and below 10 feet, 1861–1910, inclusive*—Continued.

1891 TO 1900, INCLUSIVE.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Precipitation (inches)	−0.1	+0.2	+0.2	−0.2	0	−0.2	+0.1	−0.2	−0.6	−0.5	+0.7	−0.4	−1.0
Days above 50 feet	− 2	+ 2	0	− 3	+ 1	.....	.....	− 1	.....	.....	.....	.....	− 2
Days below 5 feet	.....	.....	.....	.....	.....	+ 2	+ 6	+ 17	0	+ 59	+ 5	− 10	+ 79
Days below 10 feet	+ 11	− 11	− 3	− 1	+ 13	− 3	+ 24	+ 7	+ 52	+ 14	+ 38	+ 5	+145

1901 TO 1910, INCLUSIVE.

Precipitation (inches)	−0.6	−0.3	+0.2	0	+0.1	+0.4	−0.4	−0.4	−0.6	−0.2	−1.0	+0.1	−2.7
Days above 50 feet	+ 4	− 14	+ 18	+ 5	0	.....	.....	− 1	.....	.....	.....	.....	+ 13
Days below 5 feet	.....	.....	.....	.....	.....	− 3	− 13	− 19	− 23	− 38	+ 21	+ 25	− 50
Days below 10 feet	− 4	+ 11	+ 4	− 1	− 2	− 54	− 85	− 15	− 11	− 3	+ 44	+ 43	− 74

1861 TO 1885, INCLUSIVE.

Precipitation (inches)	+0.1	−0.1	−0.1	0	−0.1	0	+0.1	+0.2	+0.3	+0.2	0	+0.2	+0.8
Days above 50 feet	+ 1	+ 8	− 24	− 12	0	.....	.....	+ 3	.....	.....	.....	.....	− 25
Days below 5 feet	.....	.....	.....	.....	.....	+ 2	+ 6	+ 2	+ 31	− 1	− 36	− 14	− 11
Days below 10 feet	− 1	+ 2	+ 2	+ 3	− 6	+ 68	+ 67	+ 11	− 18	+ 13	− 48	− 44	+ 49

1886 TO 1910, INCLUSIVE.

Precipitation (inches)	−0.1	+0.1	+0.1	−0.1	+0.2	+0.1	−0.1	−0.1	−0.4	−0.3	+0.1	−0.2	−0.8
Days above 50 feet	− 1	− 8	+ 24	+ 12	+ 1	.....	.....	− 2	.....	.....	.....	.....	+ 25
Days below 5 feet	.....	.....	.....	.....	.....	− 1	− 6	− 2	− 30	+ 1	+ 37	+ 14	+ 11
Days below 10 feet	+ 1	− 1	− 1	− 2	+ 6	− 68	− 68	− 10	+ 17	− 12	+ 47	+ 43	− 48

TABLE NO. 8.

In this table is shown the comparison between the departures of the precipitation from the normals for each month of each 10 years, and the number of days the river stages were above or below the normal number of days for the different 5 or 10 foot heights for the same 10-year periods.

TABLE 8.—*Departures of precipitation and river-stage days from normals, Ohio Watershed above Cincinnati, 1861 to 1910, inclusive.*

PRECIPITATION.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1861–1870	+0.3	−0.5	+0.2	+0.2	+0.2	−0.3	−0.3	+0.3	+1.1	+0.2	0	0	+1.5
1871–1880	−0.3	−0.6	−0.3	−0.1	−0.9	0	+1.0	+0.3	−0.3	−0.2	+0.1	+0.2	−1.3
1881–1890	+0.7	+1.1	−0.4	−0.1	+0.7	+0.1	−0.5	+0.3	+0.2	+0.5	+0.4	0	+3.0
1891–1900	−0.1	+0.2	+0.2	−0.2	0	−0.2	+0.1	−0.2	−0.6	−0.5	+0.7	−0.4	−1.0
1901–1910	−0.6	−0.3	+0.2	0	+0.1	+0.4	−0.4	−0.4	−0.6	−0.2	−1.0	+0.1	−2.7

DAYS WITH RIVER 0 TO 4.9 FEET, INCLUSIVE.

1861–1870	.....	.....	.....	.....	.....	+ 5	+ 5	+ 5	− 8	−39	−33	− 3	−70
1871–1880	.....	.....	.....	.....	.....	− 3	+ 5	− 7	+ 4	+43	+ 3	−10	+35
1881–1890	.....	.....	.....	.....	.....	− 3	− 4	+ 6	+28	−21	+ 2	− 3	+ 7
1891–1900	.....	.....	.....	.....	.....	+ 2	+ 6	+17	0	+59	+ 5	−10	+79
1901–1910	.....	.....	.....	.....	.....	− 3	−13	−19	−23	−38	+21	+25	−50

TABLE 8.—*Departures of precipitation and river-stage days from normals, Ohio watershed above Cincinnati, 1861 to 1910, inclusive*—Continued.

DAYS WITH RIVER 5 TO 9.9 FEET, INCLUSIVE.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1861-1870	−12	− 1	− 3	− 1	−16	+ 3	+44	+11	−32	+ 7	+20	−14	+ 6
1871-1880	+16	+ 3	+ 3	+ 3	+21	+82	+10	+ 6	+30	0	−22	+ 1	+154
1881-1890	− 9	− 4	+ 1	0	−15	−28	− 1	−13	−61	+ 1	−53	−21	−203
1891-1900	+11	−11	− 3	− 1	+13	− 6	+19	−10	+52	−45	+33	+15	+ 69
1901-1910	− 4	+11	+ 4	− 1	− 2	−52	−71	+ 4	+12	+25	+13	+18	− 23

DAYS WITH RIVER 10 TO 19.9 FEET, INCLUSIVE.

1861-1870	+ 8	+ 2	−19	−51	− 8	+ 2	−41	− 5	+22	+18	− 1	− 4	−76
1871-1880	−14	+10	+19	+36	+ 7	−30	− 8	− 3	−38	−32	+37	+ 3	−13
1881-1890	−27	−34	+26	+15	+17	− 4	− 2	+ 9	+29	+ 4	+ 4	+27	+64
1891-1900	+12	− 2	− 7	+ 9	− 6	+20	−20	−19	−37	− 8	−16	+17	−55
1901-1910	+21	+21	−19	− 9	− 8	+10	+69	+20	+26	+17	−25	−41	+82

DAYS WITH RIVER 20 TO 29.9 FEET, INCLUSIVE.

1861-1870	− 3	+12	+ 8	+28	+12	− 3	− 4	− 5	+12	+10	+20	+ 9	+99
1871-1880	+ 3	+19	+14	−20	−13	−42	−17	− 2	+ 3	− 8	−16	− 8	−84
1881-1890	+26	−20	− 3	−23	− 9	+19	+ 7	+ 1	+ 5	+11	+30	+ 3	+50
1891-1900	−19	− 5	+ 3	+ 4	+ 3	−13	− 7	+ 6	− 9	− 3	−18	+ 2	−53
1901-1910	− 7	− 7	−22	+ 9	+ 5	+29	+19	+ 1	− 9	−11	−16	− 8	−14

DAYS WITH RIVER 30 TO 39.9 FEET, INCLUSIVE.

1861-1870	+14	+ 7	+12	+ 7	+14	− 9	− 4	− 3	+ 4	+ 4	− 6	+12	+52
1871-1880	0	− 9	+ 7	− 2	−10	− 9	+10	− 1	+ 3	− 3	− 2	+ 8	− 8
1881-1890	+ 6	− 7	−18	+ 6	+ 8	+14	− 2	0	+ 1	+ 5	+17	− 7	+23
1891-1900	− 8	+15	+17	− 8	− 9	− 5	0	+ 7	− 4	− 3	− 4	−18	−20
1901-1910	−10	− 7	−18	− 5	− 5	+ 9	− 4	− 3	− 4	− 3	− 3	+ 5	−48

DAYS WITH RIVER 40 TO 49.9 FEET, INCLUSIVE.

1861-1870	−12	−10	+ 2	+17	− 3	− 1	0	− 1	+ 3	+ 2	.....	0	− 3
1871-1880	− 3	− 8	−26	−11	− 4	− 1	0	+ 3	− 1	0	.....	+ 6	−45
1881-1890	+ 9	+24	− 4	− 4	0	− 1	0	− 1	− 1	0	.....	+ 1	+25
1891-1900	+ 6	− 1	−11	− 3	− 2	− 1	+ 2	+ 1	− 1	0	.....	− 6	−16
1901-1910	− 4	− 6	+38	− 1	+10	+ 4	0	− 1	− 1	0	.....	+ 1	+40

DAYS WITH RIVER 50 TO 59.9 FEET, INCLUSIVE.

1861-1870	+ 6	− 8	+ 2	− 1	+ 1	.....	.....	.....	.....	.....	.....	.....	− 1
1871-1880	0	−11	−15	− 7	− 1	.....	.....	.....	.....	.....	.....	.....	−30
1881-1890	− 6	+24	0	+ 5	− 1	.....	.....	.....	.....	.....	.....	.....	+21
1891-1900	− 1	+ 5	− 1	− 2	+ 1	.....	.....	.....	.....	.....	.....	.....	+ 1
1901-1910	− 1	− 9	+15	+ 6	0	.....	.....	.....	.....	.....	.....	.....	+10

DAYS WITH RIVER 60 TO 69.9 FEET, INCLUSIVE.

1861-1870	− 1	− 4	− 1	.....	.....	.....	.....	.....	.....	.....	.....	.....	− 6
1871-1880	− 1	− 4	− 1	.....	.....	.....	.....	.....	.....	.....	.....	.....	− 6
1881-1890	− 1	+14	− 1	.....	.....	.....	.....	.....	.....	.....	.....	.....	+12
1891-1900	− 1	− 2	+ 1	.....	.....	.....	.....	.....	.....	.....	.....	.....	− 2
1901-1910	+ 5	− 4	+ 3	.....	.....	.....	.....	.....	.....	.....	.....	.....	+ 4

DAYS WITH RIVER 70 TO 79.9 FEET, INCLUSIVE.

1861-1870	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0
1871-1880	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0
1881-1890	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	+ 2
1891-1900	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0
1901-1910	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0

Table No. 9.

This table shows the number of days the Ohio River at Cincinnati was above the flood stage of 50 feet for each month during the entire 50 years, together with the totals for each year and for each month.

Table 9.—*Total number of days with river above 50 feet at Cincinnati, Ohio, 1861 to 1910, inclusive.*

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	Days.	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*
1861	0	0	0	0	0	0	0	0	0	0	0	0	0
1862	6	0	0	6	0	0	0	0	0	0	0	0	12
1863	0	0	0	0	0	0	0	0	0	0	0	0	0
1864	0	0	0	0	0	0	0	0	0	0	0	0	0
1865	0	0	5	0	2	0	0	0	0	0	0	0	7
1866	0	0	0	0	0	0	0	0	0	0	0	0	0
1867	0	7	12	0	0	0	0	0	0	0	0	0	19
1868	0	0	0	0	0	0	0	0	0	0	0	0	0
1869	0	0	0	0	0	0	0	0	0	0	0	0	0
1870	6	0	0	0	0	0	0	0	0	0	0	0	6
1871	0	0	0	0	0	0	0	0	0	0	0	0	0
1872	0	0	0	0	0	0	0	0	0	0	0	0	0
1873	0	0	0	0	0	0	0	0	0	0	0	0	0
1874	0	0	0	0	0	0	0	0	0	0	0	0	0
1875	0	0	0	0	0	0	0	5	0	0	0	0	5
1876	1	0	0	0	0	0	0	0	0	0	0	0	1
1877	5	0	0	0	0	0	0	0	0	0	0	0	5
1878	0	0	0	0	0	0	0	0	0	0	0	0	0
1879	0	0	0	0	0	0	0	0	0	0	0	0	0
1880	0	4	0	0	0	0	0	0	0	0	0	0	4
1881	0	2	0	0	0	0	0	0	0	0	0	0	2
1882	0	9	0	0	0	0	0	0	0	0	0	0	9
1883	0	16	0	0	0	0	0	0	0	0	0	0	16
1884	0	19	0	0	0	0	0	0	0	0	0	0	19
1885	0	0	0	0	0	0	0	0	0	0	0	0	0
1886	0	0	0	12	0	0	0	0	0	0	0	0	12
1887	0	10	3	0	0	0	0	0	0	0	0	0	13
1888	0	0	0	0	0	0	0	0	0	0	0	0	0
1889	0	0	0	0	0	0	0	0	0	0	0	0	0
1890	0	3	12	0	0	0	0	0	0	0	0	0	15
1891	0	8	0	0	0	0	0	0	0	0	0	0	8
1892	0	0	0	0	0	0	0	0	0	0	0	0	0
1893	0	8	0	0	2	0	0	0	0	0	0	0	10
1894	0	0	0	0	0	0	0	0	0	0	0	0	0
1895	0	0	0	0	0	0	0	0	0	0	0	0	0
1896	0	0	0	0	0	0	0	0	0	0	0	0	0
1897	0	6	2	0	0	0	0	0	0	0	0	0	8
1898	5	0	7	3	0	0	0	0	0	0	0	0	15
1899	0	0	7	2	0	0	0	0	0	0	0	0	9
1900	0	0	0	0	0	0	0	0	0	0	0	0	0
1901	0	0	0	8	1	0	0	0	0	0	0	0	9
1902	0	0	4	0	0	0	0	0	0	0	0	0	4
1903	0	0	8	0	0	0	0	0	0	0	0	0	8
1904	0	0	0	0	0	0	0	0	0	0	0	0	0
1905	0	0	0	0	0	0	0	0	0	0	0	0	0
1906	0	0	0	1	0	0	0	0	0	0	0	0	1
1907	11	0	11	0	0	0	0	0	0	0	0	0	22
1908	0	2	6	4	0	0	0	0	0	0	0	0	12
1909	0	4	2	0	0	0	0	0	0	0	0	0	6
1910	0	0	3	0	0	0	0	0	0	0	0	0	3
Sums	34	98	82	36	5	0	0	5	0	0	0	0	260

Table No. 10.

The table shows the number of days the Ohio River at Cincinnati was above the 40-foot stage for each month during the entire 50 years, together with the totals for each year and for each month.

Table 10.—*Total number of days with river above 40 feet at Cincinnati, Ohio, 1861 to 1910, inclusive.*

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	Days.	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*
1861	2	0	0	7	0	0	0	0	0	2	0	0	11
1862	10	10	6	15	0	0	0	0	0	0	0	0	41
1863	1	1	3	0	0	0	0	0	0	0	0	0	5
1864	0	0	0	0	0	0	0	0	0	0	0	5	5
1865	0	2	19	6	8	0	0	0	0	0	0	2	37
1866	0	0	0	0	0	0	0	0	2	0	0	0	2
1867	0	15	19	0	0	0	0	0	0	0	0	0	34
1868	3	0	10	2	2	0	0	0	2	0	0	0	19
1869	0	0	2	6	0	0	0	0	0	0	0	0	8
1870	10	0	2	13	0	0	0	0	0	0	0	0	25
1871	0	0	0	0	1	0	0	0	0	0	0	0	1
1872	0	0	0	5	0	0	0	0	0	0	0	0	5
1873	0	3	0	0	0	0	0	0	0	0	0	4	7
1874	6	5	0	6	4	0	0	0	0	0	0	0	21
1875	0	0	5	0	0	0	0	9	0	0	0	4	18
1876	11	10	1	1	0	0	0	0	0	0	0	0	23
1877	9	0	3	0	0	0	0	0	0	0	0	0	12
1878	0	0	0	0	0	0	0	0	0	0	0	3	3
1879	0	2	0	0	0	0	0	0	0	0	0	2	4
1880	3	7	7	3	2	0	0	0	0	0	0	0	22
1881	0	9	0	3	0	0	0	0	0	0	0	2	14
1882	23	20	6	0	4	0	0	0	0	0	0	0	53
1883	0	18	0	9	0	0	0	0	0	0	0	6	33
1884	0	25	15	0	0	0	0	0	0	0	0	0	40
1885	5	0	0	0	0	0	0	0	0	0	0	0	5
1886	0	1	1	16	0	0	0	0	0	0	0	0	18
1887	3	28	7	5	0	0	0	0	0	0	0	0	43
1888	0	0	0	0	0	0	0	0	0	0	0	0	0
1889	0	0	0	0	0	0	0	0	0	0	0	0	0
1890	6	13	24	1	7	0	0	0	0	0	0	0	51
1891	6	26	10	6	0	0	0	0	0	0	0	0	48
1892	2	0	0	6	0	0	0	0	0	0	0	0	8
1893	0	14	0	1	11	0	0	0	0	0	0	0	26
1894	0	0	0	0	0	0	0	0	0	0	0	0	0
1895	5	0	0	0	0	0	0	0	0	0	0	0	5
1896	0	0	0	6	0	0	2	2	0	0	0	0	10
1897	0	12	14	0	0	0	0	0	0	0	0	0	26
1898	16	0	10	5	0	0	0	0	0	0	0	0	31
1899	8	0	13	4	0	0	0	0	0	0	0	0	25
1900	0	0	0	0	0	0	0	0	0	0	0	1	1
1901	0	0	0	10	3	2	0	0	0	0	0	0	15
1902	2	2	15	3	0	0	0	0	0	0	0	7	29
1903	0	14	19	5	0	0	0	0	0	0	0	0	38
1904	4	0	14	5	0	0	0	0	0	0	0	0	23
1905	0	0	11	0	6	0	0	0	0	0	0	1	18
1906	0	0	1	6	0	0	0	0	0	0	0	0	7
1907	19	0	15	0	0	3	0	0	0	0	0	0	37
1908	0	9	19	9	6	0	0	0	0	0	0	0	43
1909	0	5	8	0	7	0	0	0	0	0	0	0	20
1910	8	1	12	0	0	0	0	0	0	0	0	0	21
Sums	162	252	291	164	61	5	2	11	4	2	0	37	991

Table No. 11.

This table shows the number of days the Ohio River at Cincinnati was below the 10-foot stage for each month during the entire 50 years, together with the totals for each year and for each month.

Table 11.—*Total number of days with river below 10 feet at Cincinnati, Ohio, 1861–1910, inclusive.*

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
	Days.	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*
1861	0	0	0	0	0	12	31	11	22	0	0	0	76
1862	0	0	0	0	0	0	8	31	30	31	27	23	150
1863	0	0	0	0	4	30	24	31	30	31	22	6	178
1864	6	7	0	0	0	11	31	21	3	9	2	0	90
1865	0	0	0	0	0	0	9	13	8	25	16	11	82
1866	0	0	0	0	5	30	18	22	7	5	1	0	88
1867	0	0	0	0	0	1	28	31	30	31	30	15	166
1868	0	3	0	0	0	3	31	21	10	20	5	0	93
1869	0	0	0	0	0	0	0	22	19	24	23	0	88
1870	0	0	0	0	0	2	17	9	26	31	25	1	111
1871	14	0	0	0	3	27	31	31	30	31	24	25	216
1872	11	9	5	4	8	12	11	23	30	31	17	19	180
1873	0	0	0	0	0	23	6	12	25	24	4	0	94
1874	0	0	0	0	7	30	29	24	30	31	27	3	181
1875	5	4	0	0	6	4	0	1	30	31	6	0	87
1876	0	0	0	0	0	15	8	18	12	17	8	7	85
1877	0	1	1	0	0	10	11	31	30	31	16	0	131
1878	4	0	0	0	0	9	22	17	18	26	4	0	100
1879	0	0	0	0	10	25	31	18	24	31	25	7	171
1880	0	0	0	0	12	5	14	21	30	31	14	3	130
1881	5	0	0	0	2	8	25	31	30	31	6	0	138
1882	0	0	0	0	0	0	2	11	0	21	30	6	70
1883	0	0	0	0	0	0	2	21	30	24	0	0	77
1884	0	0	0	0	0	8	18	27	30	31	30	12	156
1885	0	4	4	1	0	4	29	3	12	17	0	0	74
1886	0	0	0	0	0	2	6	14	30	31	17	0	100
1887	0	0	0	0	3	9	31	31	30	31	30	31	196
1888	4	3	0	0	5	19	12	20	2	11	0	0	76
1889	0	0	0	0	0	0	0	10	28	24	0	0	62
1890	0	0	0	0	0	0	18	21	0	0	0	0	39
1891	0	0	0	0	20	0	3	12	17	31	21	0	104
1892	0	0	0	0	0	0	10	28	30	31	30	18	147
1893	5	0	0	0	0	0	21	31	25	15	18	2	117
1894	0	0	0	0	2	11	31	31	26	31	30	11	173
1895	5	0	0	0	0	29	28	31	30	31	30	23	207
1896	11	0	0	0	10	6	1	0	30	2	1	0	61
1897	1	0	0	0	0	6	6	20	30	31	19	0	113
1898	0	0	0	0	0	9	25	0	29	22	0	0	85
1899	0	0	0	0	0	0	26	24	30	31	30	15	156
1900	7	0	0	0	6	16	22	26	30	30	23	9	169
1901	4	4	7	0	0	0	4	14	12	31	29	0	105
1902	6	8	0	0	4	15	0	18	30	27	27	0	135
1903	0	0	0	0	12	0	2	31	22	27	23	21	138
1904	0	0	0	0	0	4	8	31	30	31	30	30	164
1905	1	7	0	0	0	0	0	3	14	19	0	0	44
1906	0	3	0	0	7	3	17	5	16	0	8	0	59
1907	0	0	0	0	0	0	0	5	1	18	2	0	26
1908	0	0	0	0	0	4	19	24	30	31	30	26	164
1909	1	0	0	0	0	0	9	19	30	30	29	23	141
1910	2	0	0	0	0	0	5	31	29	24	30	16	137
Sums	92	53	17	5	126	402	740	981	1,127	1,205	819	363	5,930

Table No. 12.

A correlation is here shown between the precipitation for August, September, and October and the number of days that the river was below 10 feet at Cincinnati, during the same months, for each year of the entire 50 years. This is the usual correlation table. In these tables the correlation coefficient "r" is determined by dividing the sum of column 8 by the square root of the product of the sums of

columns 4 and 7. If the correlation coefficient be 1 in this calculation, there is an exact relation between the two factors, and if -1 there is an exact opposite connection. In this case $426.74 \times 26{,}562$ (the sums of columns 4 and 7, respectively) $= 11{,}335{,}067.88$. The square root of this product is 3,366.76. The sum of column 8 is $-2{,}490.8$. This sum divided by $3{,}366.76 = -0.74$. This is a very high negative coefficient and shows plainly that the smaller the amount of rainfall during August, September, and October the greater the number of days with the river below 10 feet.

It is considered safe to assume that there is a well-defined relation in these cases if "r" is six times the probable error. The probable error is obtained by the following formula: $0.674 \frac{1-r^2}{\sqrt{N}}$. In which "r" is the correlation coefficient and N the number of years under discussion. The probable error here is ± 0.04, or only one-eighteenth of "r."

The question might properly be raised as to whether the rainfall during July might have a marked influence on the low-water days in August, September, and October, as discussed in this table. But a similar correlation table worked out for the rainfall for July, August, September, and October, and the number of days with the river below 10 feet in August, September, and October, gives a correlation coefficient of -0.73, or very slightly less than with July rainfall omitted.

TABLE 12.—*Correlation of precipitation and days with river below 10 feet, in August, September, and October, Ohio River, Cincinnati, Ohio, 1861 to 1910, inclusive.*

Years.	Precipitation.			Days.			Product of columns 3 and 6.
	Precipitation.	Departure.	Square of column 3.	Days.	Departure.	Square of column 6.	
1	2	3	4	5	6	7	8
	Inches.	*Inches.*		*Days.*	*Days.*		
1861	11.4	+2.7	7.29	33	−33	1,089	− 89.2
1862	5.0	−3.7	13.69	92	+26	676	− 96.2
1863	8.7	0	0	92	+26	676	0
1864	12.7	+4.0	16.00	33	−33	1,089	− 132.0
1865	10.2	+1.5	2.25	46	−20	400	− 30.0
1866	17.2	+8.5	72.25	34	−32	1,024	− 272.0
1867	6.6	−2.1	4.41	92	+26	676	− 54.6
1868	13.9	+5.2	27.04	51	−15	225	− 78.0
1869	8.2	−0.5	.25	65	− 1	1	+ 0.5
1870	7.4	−1.3	1.69	66	0	0	0
1871	7.5	−1.2	1.44	92	+26	676	− 31.2
1872	7.2	−1.5	2.25	84	+18	324	− 27.0
1873	10.6	+1.9	3.61	61	− 5	25	− 9.5
1874	5.6	−3.1	9.61	85	+19	364	− 58.9
1875	7.8	−0.9	.81	62	− 4	16	+ 3.6
1876	11.5	+2.8	7.84	47	−19	361	− 53.2
1877	5.9	−2.8	7.84	92	+26	676	− 72.8
1878	10.1	+1.4	1.96	61	− 5	25	− 7.0
1879	9.7	+1.0	1.00	73	+ 7	49	+ 7.0
1880	9.5	+0.8	.64	82	+16	256	+ 12.8
1881	8.8	+0.1	.01	92	+26	676	+ 2.6
1882	10.1	+1.4	1.96	32	−34	1,156	− 47.6
1883	9.3	+0.6	.36	75	+ 9	81	+ 5.4
1884	6.8	−1.9	3.61	88	+22	284	− 41.8
1885	12.0	+3.3	10.89	32	−34	1,156	− 112.2
1886	8.1	−0.6	0.36	75	+ 9	81	− 5.4
1887	5.4	−3.3	10.89	92	+26	676	− 85.8
1888	14.3	+5.6	31.36	33	−33	1,089	− 184.8
1889	7.4	−1.3	1.69	62	− 4	16	+ 5.2

TABLE 12.—*Correlation of precipitation and days with river below 10 feet in August, September, and October, Ohio River, Cincinnati Ohio, 1861 to 1910, inclusive*—Continued.

Years.	Precipitation.			Days.			Product of columns 3 and 6.
	Precipitation.	Departure.	Square of column 3.	Days.	Departure.	Square of column 6.	
1	2	3	4	5	6	7	8
	Inches.	*Inches.*		*Days.*	*Days.*		
1890	14.6	+5.9	34.81	21	−45	2,025	− 265.5
1891	6.5	−2.2	4.84	60	− 6	36	+ 13.2
1892	6.5	−2.2	4.84	89	+23	529	− 50.6
1893	8.7	0	0	71	+ 5	25	0
1894	7.2	−1.5	2.25	88	+22	484	− 33.0
1895	5.1	−3.6	12.96	92	+26	676	− 93.6
1896	10.3	+1.6	2.56	32	−34	1,156	− 54.4
1897	3.8	−4.9	24.01	81	+15	225	− 73.5
1898	10.9	+2.2	4.84	51	−15	225	− 33.0
1899	7.3	−1.4	1.96	85	+19	361	− 26.6
1900	6.8	−1.9	3.61	86	+20	400	− 38.0
1901	6.4	−2.3	5.29	57	− 9	81	+ 20.7
1902	7.5	−1.2	1.44	75	+ 9	81	− 10.8
1903	5.5	−3.2	10.24	80	+14	196	− 44.8
1904	4.7	−4.0	16.00	92	+26	676	− 104.0
1905	12.5	+3.8	14.44	36	−30	900	− 114.0
1906	10.9	+2.2	4.84	21	−45	2,025	− 99.0
1907	7.7	−1.0	10.00	24	−42	1,764	+ 42.0
1908	4.3	−4.4	19.36	85	+19	361	− 83.6
1909	7.1	−1.6	2.56	79	+13	169	− 20.8
1910	10.4	+1.7	2.89	84	+18	324	+ 30.6
Sums			426.74			26,562	−2,490.8
Means	8.7			66			

The correlation coefficient is −0.74. The probable error is ±0.04.

TABLE 13.

In Table 13 the correlation coefficient is determined for the precipitation over the Ohio watershed above Cincinnati, and the number of days that the river was above 40 feet at Cincinnati, during the months of February and March, for the 50 years. The effect of the precipitation upon the flood conditions is more remarkable, if possible, than upon the low-water days as indicated in Table 12, because the correlation coefficient is 0.80 in Table 13. This is 27 times the probable error. This table alone should be very conclusive evidence that the high-water conditions in the Ohio Valley, during the months when there are the greatest number of high-water days, are controlled by the precipitation and nothing else.

By obtaining the correlation coefficient for the different 25-year periods from this table the fact that the cutting off of the forests does not make increased flood conditions is plainly established. The correlation coefficient for the 25 years from 1861 to 1885, inclusive, is 0.805, and for the 25 years from 1886 to 1910, inclusive, is 0.804, a difference much less than the probable error. This means that the tendency to cause the water to rise above 40 feet by the same precipitation has been no greater during the last 25 years than during the preceding 25 years, or at least by a value too small to be calculated by the most approved method of correlation.

TABLE 13.—*Precipitation and days with river above 40 feet in February and March, Ohio River, Cincinnati, Ohio, 1861 to 1910, inclusive.*

Years.	Precipitation.			Days.			Product of columns 3 and 6.
	Precipitation.	Departure.	Square of column 3.	Days.	Departure.	Square of column 6.	
1	2	3	4	5	6	7	8
	Inches.	*Inches.*		*Days.*	*Days.*		
1861	4.3	−2.7	7.29	0	−11	121	+ 29.7
1862	7.7	+0.1	.49	16	+ 5	25	+ 0.5
1863	7.1	+0.1	.01	4	− 7	49	− 0.7
1864	4.0	−3.0	9.00	0	−11	121	+ 33.0
1865	7.4	+0.4	.16	21	+10	100	+ 4.0
1866	6.2	−0.8	.64	0	−11	121	+ 8.8
1867	10.0	+3.0	9.00	34	+23	529	+ 69.0
1868	6.5	−0.5	.25	10	− 1	1	+ 0.5
1869	7.1	+0.1	.01	2	− 9	81	− 0.9
1870	7.3	+0.3	.09	2	− 9	81	− 2.7
1871	5.3	−1.7	2.89	0	−11	121	+ 18.7
1872	3.4	−3.6	12.96	0	−11	121	+ 39.6
1873	6.7	−0.3	.09	3	− 8	64	+ 2.4
1874	7.6	+0.6	.36	5	− 6	36	− 3.6
1875	5.8	−1.2	1.44	5	− 6	36	+ 7.2
1876	6.3	−0.7	.49	11	0	0	0
1877	6.0	−1.0	1.00	3	− 8	64	+ 8.0
1878	4.7	−2.3	5.92	0	−11	121	+ 25.3
1879	7.1	+0.1	.01	2	− 9	81	− 0.9
1880	8.0	+1.0	1.00	14	+ 5	25	+ 5.0
1881	7.2	+0.2	.04	9	− 2	4	− 0.4
1882	10.1	+3.1	9.61	26	+15	225	+ 46.5
1883	10.2	+3.2	10.24	18	+ 7	49	+ 22.4
1884	10.2	+3.2	10.24	40	+29	841	+ 92.8
1885	3.3	−3.7	13.69	0	−11	121	+ 40.7
1886	5.1	−1.9	3.61	2	− 9	81	+ 17.1
1887	9.4	+2.4	5.76	35	+24	576	+ 57.6
1888	6.1	−0.9	.81	0	−11	121	+ 9.9
1889	2.9	−4.1	16.81	0	−11	121	+ 45.1
1890	12.3	+5.3	28.09	37	+26	676	+ 137.8
1891	10.0	+3.0	9.00	36	+25	625	+ 75.0
1892	6.1	−0.9	.81	0	−11	121	+ 9.9
1893	7.4	+0.4	.16	14	+ 3	9	+ 1.2
1894	5.9	−1.1	1.21	0	−11	121	+ 12.1
1895	3.1	−3.9	15.21	0	−11	121	+ 42.9
1896	6.7	−0.3	.09	0	−11	121	+ 3.3
1897	11.3	+4.3	18.49	26	+15	225	+ 64.5
1898	9.3	+2.3	5.29	10	− 1	1	− 2.3
1899	8.4	+1.4	1.96	13	+ 2	4	+ 2.8
1900	5.4	−1.6	2.56	0	−11	121	+ 17.6
1901	3.7	−3.3	10.89	0	−11	121	+ 36.3
1902	4.2	−2.8	7.84	17	+ 6	36	− 16.8
1903	9.9	+2.9	8.41	33	+22	484	+ 63.8
1904	8.0	+1.0	1.00	14	+ 3	9	+ 3.0
1905	5.2	−1.8	3.21	11	0	0	0
1906	6.9	−0.1	.01	1	−10	100	+ 1.0
1907	7.0	0	0	15	+ 4	16	0
1908	10.6	+3.6	12.96	28	+17	289	+ 61.2
1909	8.9	+1.9	3.61	13	+ 2	4	+ 3.8
1910	7.3	+0.3	.09	13	+ 2	4	+ 0.6
Sums			254.80			7,245	+1,092.3
Means	7.0			11			

The correlation coefficient is 0.80. The probable error is ±0.03.

TABLE 14.

In this table the same calculation is made for the relation between the precipitation in February and March and the number of days above 50 feet, or flood stage. One would not expect this correlation coefficient to be so high as in Table 13, even if the relation is actually closer, because of the great number of years when the river did not

rise above 50 feet during these two months. And yet in this case "r" equals 0.74; high enough to make the relation well marked. The determination of the correlation coefficient in this table for each of the 25-year periods shows that the tendency to produce flood days with the same rainfall is slightly less during the last 25 years than during the preceding, although by a value too small to be considered, being about 0.3 per cent.

TABLE 14.—*Precipitation and days with river above 50 feet in February and March, Ohio River, Cincinnati, Ohio, 1861 to 1910, inclusive.*

Years.	Precipitation.			Days.			Product of columns 3 and 6.
	Precipitation.	Departure.	Square of column 3.	Days.	Departure.	Square of column 6.	
1	2	3	4	5	6	7	8
	Inches.	*Inches.*		*Days.*	*Days.*		
1861	4.3	−2.7	7.29	0	− 4	16	+ 10.8
1862	7.7	+0.7	.49	0	− 4	16	− 2.8
1863	7.1	+0.1	.01	0	− 4	16	− 0.4
1864	4.0	−3.0	9.00	0	− 4	16	+ 12.0
1865	7.4	+0.4	.16	5	+ 1	1	+ 0.4
1866	6.2	−0.8	.64	0	− 4	16	+ 3.2
1867	10.0	+3.0	9.00	19	+15	225	+ 45.0
1868	6.5	−0.5	.25	0	− 4	16	+ 2.0
1869	7.1	+0.1	.01	0	− 4	16	− 0.4
1870	7.3	+0.3	.09	0	− 4	16	− 1.2
1871	5.3	−1.7	2.89	0	− 4	16	+ 6.8
1872	3.4	−3.6	12.96	0	− 4	16	+ 14.4
1873	6.7	−0.3	.09	0	− 4	16	+ 1.2
1874	7.6	+0.6	.36	0	− 4	16	− 2.4
1875	5.8	−1.2	1.44	0	− 4	16	+ 4.8
1876	6.3	−0.7	.49	0	− 4	16	+ 2.8
1877	6.0	−1.0	1.00	0	− 4	16	+ 4.0
1878	4.7	−2.3	5.92	0	− 4	16	+ 9.2
1879	7.1	+0.1	.01	0	− 4	16	− 0.4
1880	8.0	+1.0	1.00	4	0	0	0
1881	7.2	+0.2	.04	2	− 2	4	− 0.4
1882	10.1	+3.1	9.61	9	+ 5	25	+ 15.5
1883	10.2	+3.2	10.24	16	+12	144	+ 38.4
1884	10.2	+3.2	10.24	19	+15	225	+ 48.0
1885	3.3	−3.7	13.69	0	− 4	16	+ 14.8
1886	5.1	−1.9	3.61	0	− 4	16	+ 7.6
1887	9.4	+2.4	5.76	13	+ 9	81	+ 21.6
1888	6.1	−0.9	.81	0	− 4	16	+ 3.6
1889	2.9	−4.1	16.81	0	− 4	16	+ 16.4
1890	12.3	+5.3	28.09	15	+11	121	+ 58.3
1891	10.0	+3.0	9.00	8	+ 4	16	+ 12.0
1892	6.1	−0.9	.81	0	− 4	16	+ 3.6
1893	7.4	+0.4	.16	8	+ 4	16	+ 1.6
1894	5.9	−1.1	1.21	0	− 4	16	+ 4.4
1895	3.1	−3.9	15.21	0	− 4	16	+ 15.6
1896	6.7	−0.3	.09	0	− 4	16	+ 1.2
1897	11.3	+4.3	18.49	8	+ 4	16	+ 17.2
1898	9.3	+2.3	5.29	7	+ 3	9	+ 6.9
1899	8.4	+1.4	1.96	7	+ 3	9	+ 4.2
1900	5.4	−1.6	2.56	0	− 4	16	+ 6.4
1901	3.7	−3.3	10.89	0	− 4	16	+ 13.2
1902	4.2	−2.8	7.84	4	0	0	0
1903	9.9	+2.9	8.41	8	+ 4	16	+ 11.6
1904	8.0	+1.0	1.00	0	− 4	16	− 4.0
1905	5.2	−1.8	3.21	0	− 4	16	+ 7.3
1906	6.9	−0.1	.01	0	− 4	16	+ 0.4
1907	7.0	0	0	11	+ 7	49	0
1908	10.6	+3.6	12.96	8	+ 4	16	+ 14.4
1909	8.9	+1.9	3.61	6	+ 2	4	+ 3.8
1910	7.3	+0.3	.09	3	− 1	1	− 0.3
Sum			254.80			1,458	+452.3
Mean	7.0			4			

The correlation coefficient is 0.74.

Table 15.

In this table the years, precipitation, and river stages are grouped for each difference in precipitation amounting to 1 inch for February and March. This table shows several important facts, among them being:

(1) In only one year has the river reached the flood stage during these months when the precipitation was less than the normal, 7 inches.

(2) The most marked increase in flood days comes with the increase of the precipitation from between 9 and 10 inches to between 10 and 11 inches.

(3) The average rate of increase in number of flood days with each increase of 1 inch in the precipitation is 2.5; this calculation is made for years when the precipitation was above 7 inches.

Table 15.—*Precipitation and days with river above 50 feet in February and March, Ohio River, Cincinnati, Ohio, 1861 to 1910, inclusive.*

Precipitation between—	Years.	Precipitation.	Days.	Change.
2.9 and 3.9 inches	1872	3.4	0	
	1885	3.3	0	
	1889	2.9	0	
	1895	3.1	0	
	1901	3.7	0	
4 and 4.9 inches	1861	4.3	0	
	1864	4.0	0	
	1878	4.7	0	
	1902	4.2	4	
5 and 5.9 inches	1871	5.3	0	
	1875	5.8	0	
	1886	5.1	0	
	1894	5.9	0	
	1900	5.4	0	
	1905	5.2	0	
6 and 6.9 inches	1866	6.2	0	
	1868	6.5	0	
	1873	6.7	0	
	1876	6.3	0	
	1877	6.0	0	
	1888	6.1	0	
	1892	6.1	0	
	1896	6.7	0	
	1906	6.9	0	
7 and 7.9 inches	1862	7.7	0	
	1863	7.1	0	
	1865	7.4	5	
	1869	7.1	0	
	1870	7.3	0	
	1874	7.6	0	
	1879	7.1	0	
	1881	7.2	2	
	1893	7.4	8	
	1907	7.0	11	
	1910	7.3	3	
Mean			2	
8 and 8.9 inches	1880	8.0	4	
	1899	8.4	7	
	1904	8.0	0	
	1906	8.9	9	
Mean			5	3

TABLE 15.—*Precipitation and days with river above 50 feet in February and March, Ohio River, Cincinnati, Ohio, 1861 to 1910, inclusive*—Continued.

Precicipitation between—	Years.	Precipitation.	Days.	Change.
9 and 9.9 inches	1887	9.4	13	.....
	1898	9.3	7	.....
	1903	9.9	8	.....
Mean	.....	.....	9	4
10 and 10.9 inches	1867	10.0	19	.....
	1882	10.1	9	.....
	1883	10.2	16	.....
	1884	10.2	19	.....
	1891	10.0	8	.....
	1908	10.6	8	.....
Mean	.....	.....	13	4
11 inches or more	1890	12.3	15	.....
	1897	11.3	8	.....
Mean	.....	.....	12	—1
Mean change	.....	.....	.....	2.5

TABLE NO. 16.

This table groups the data when the rainfall was above the normal for February and March, by 10-year and 25-year periods, and shows plainly that instead of a tendency toward increase of flood days in recent years there is actually a decrease, with the same precipitation.

As shown by the last sentence in the discussion of Table 15, the average increase in flood days is 2.5 with each increase in precipitation of 1 inch. Then if 8.2 inches of rain from 1861 to 1885, inclusive, caused 6.5 flood days each year, the rainfall of 9.2 inches from 1886 to 1910, inclusive, should have caused 2.5 days more or 9 flood days each year. But, because the tendency to flood conditions is less, the increase of 1 inch of rain produced an increase of only 1.6 flood days per year.

Applying the same average increase of 2.5 days for each increase of 1 inch in rainfall, or 0.25 day for each increase of 0.1 inch of rain, it will be seen that the number of flood days in the 10 years, 1901 to 1910, inclusive, is exactly the same as the flood days in the 10 years, 1861 to 1870, inclusive, if the difference in rainfall is taken into consideration, and is 2.75 days less than was produced in the 10 years, 1881 to 1890, inclusive, after making allowance for the difference in rainfall.

TABLE 16.—*Precipitation and days with river above 50 feet during February and March, by 10-year periods, Ohio River, Cincinnati, Ohio, 1861–1910, inclusive.*

Year.	Year.	Precipitation.	Days.
1861 to 1870, inclusive	1862	7.7	0
	1863	7.1	0
	1865	7.4	5
	1869	7.1	0
	1870	7.3	0
	1867	10.0	19
Mean		7.8	4
1871 to 1880, inclusive	1874	7.6	0
	1879	7.1	0
	1880	8.0	4
Mean		7.6	1
1881 to 1890, inclusive	1881	7.2	2
	1887	9.4	13
	1882	10.1	9
	1883	10.2	16
	1884	10.2	19
	1890	12.3	15
Mean		9.9	12
1891 to 1900, inclusive	1893	7.4	8
	1899	8.4	7
	1898	9.3	7
	1891	10.0	8
	1897	11.3	8
Mean		9.3	8
1901 to 1910, inclusive	1910	7.3	3
	1907	7.0	11
	1904	8.0	0
	1906	8.9	9
	1903	9.9	8
	1908	10.6	8
Mean		8.6	6
Mean, 1861 to 1885, inclusive		8.2	6.5
Mean, 1886 to 1910, inclusive		9.2	8.1

TABLE NO. 17.

In Table 17 the average rainfall and average number of days with the river below 10 feet in August, September, and October is tabulated for differences in rainfall amounting to 1 inch. This shows that the average increase in low-water days with each decrease of 1 inch of rain is 7.

TABLE 17.—*Average precipitation and days with river below 10 feet for August, September, and October for each inch of rain, Ohio River, Cincinnati, Ohio, 1861 to 1910, inclusive.*

Precipitation—	Mean precipitation.	Mean days.	Change.
Below 5 inches	4.3	86	
Between 5 and 6 inches	5.4	89	+ 3
Between 6 and 7 inches	6.6	79	−10
Between 7 and 8 inches	7.4	72	− 7
Between 8 and 9 inches	8.5	79	+ 7
Between 9 and 10 inches	9.5	77	− 2
Between 10 and 11 inches	10.4	49	−28
Above 11 inches	13.3	36	−13
Mean			− 7

Table No. 18.

In Table 18 the average rainfall and average number of days with the water below 10 feet in August, September, and October is given for each 10-year and each 25-year period. Remembering that the increase in low-water days amounts to an average of 7 a year with each decrease in the rainfall of 1 inch, it will be seen at once that the number of low-water days during the 10 years from 1901 to 1910, inclusive, were less than in any of the preceding 10-year periods, taking into the account the difference in rainfall. Also that during the last 25 years the average number of low-water days is 9.1 less than would have been produced in the first 25 years with the same amount of rainfall. Or, the tendency to produce low-water conditions in the Ohio River has been 14 per cent less during the 25 years from 1886 to 1910, inclusive, than during the 25 years from 1861 to 1885, inclusive, with the same rainfall, as calculated during the low-water months of August, September, and October.

Table 18.—*Average precipitation and number of days with river below 10 feet for August, September, and October, by 10-year and 25-year periods, Ohio River, Cincinnati, Ohio, 1861–1910, inclusive.*

Year.	Precipitation.	Days.
1861 to 1870	10.1	60
1871 to 1880	8.5	74
1881 to 1890	9.7	60
1891 to 1900	7.3	74
1901 to 1910	7.7	63
1861 to 1885	9.3	66
1886 to 1910	8.0	66

Explanation of Charts.

Chart 1.—Indicates the location of the seven precipitation stations that were used in obtaining the precipitation for the Ohio watershed above Cincinnati.

Chart 2.—The influence of the rainfall upon the number of low-water days during the driest period of the year is plainly shown by this chart.

Chart 3.—The relation between the precipitation and number of high-water days during the period of highest water is well indicated. Also that an equal amount of precipitation has no greater tendency to cause an increase in the number of high-water days during the latter part of the period than during the earlier part.

Chart 4.—This chart shows that whenever the precipitation for February and March was 1 inch or more above the normal the number of days with the water above 40 feet was always greater than the normal, with one exception. Also that when the precipitation was more than 2 inches above the normal, the number of days was much above the normal, with one or two exceptions. Further, that when the precipitation was below the normal the number of days was always less than the normal, with one exception. The line of dots on the − 11 days' line indicate no days with the river above 40 feet, the average number of days being 11 per year.

CHART 1.—Location of precipitation stations.

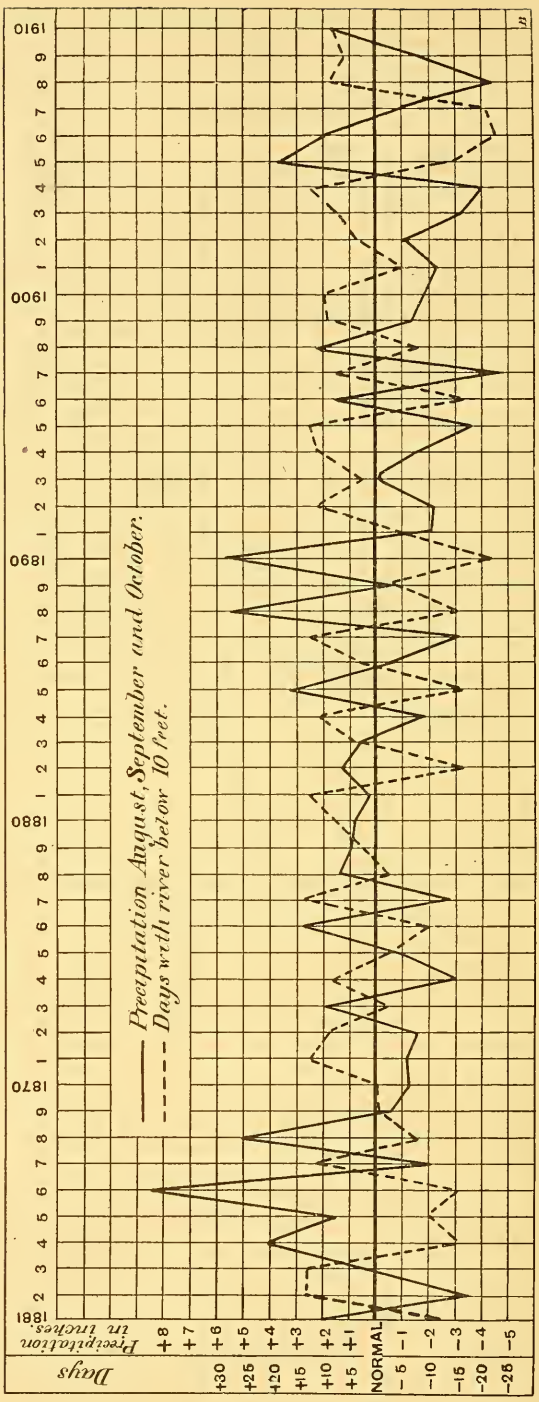

CHART 2.—Relation between precipitation and the number of low-water days during the driest period of the year.

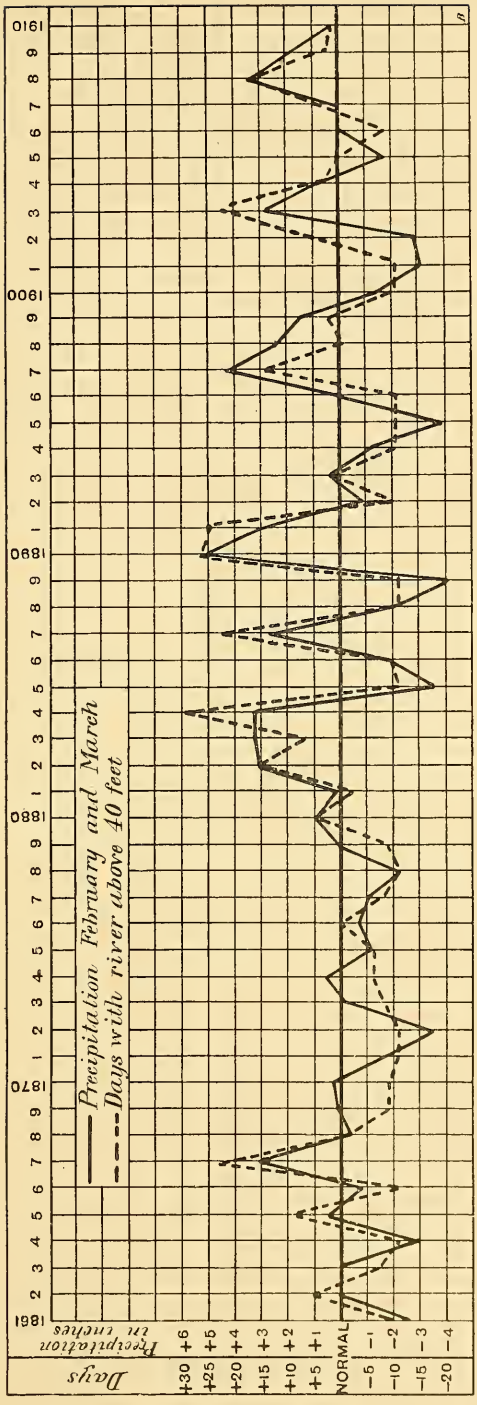

CHART 3.—Relation between precipitation and the number of high-water days during the period of highest water.

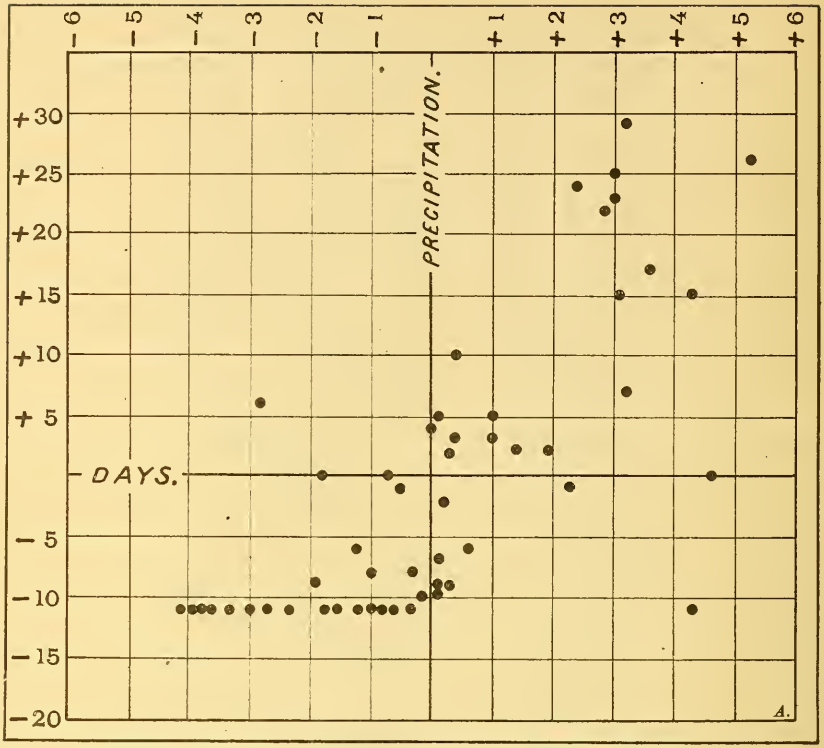

CHART 4.—Departures from normal precipitation during February and March and number of days with the river above 40 feet.