Journal of Geography

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/rjog20>

Flood Studies on Matfield River

M. S. W. Jefferson ^a

^a Professor of Geography , State Normal School ,
Ypsilanti, Mich.

Published online: 20 May 2008.

To cite this article: M. S. W. Jefferson (1902) Flood Studies on Matfield River, Journal of Geography, 1:9, 403-407, DOI: [10.1080/00221340208985891](https://doi.org/10.1080/00221340208985891)

To link to this article: <http://dx.doi.org/10.1080/00221340208985891>

PLEASE SCROLL DOWN FOR ARTICLE

Taylor & Francis makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications on our platform. However, Taylor & Francis, our agents, and our licensors make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors, and are not the views of or endorsed by Taylor & Francis. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Taylor and Francis shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to or arising out of the use of the Content.

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is

expressly forbidden. Terms & Conditions of access and use can be found at
<http://www.tandfonline.com/page/terms-and-conditions>

FLOOD STUDIES ON MATFIELD RIVER*

BY M. S. W. JEFFERSON, PROFESSOR OF GEOGRAPHY, STATE NORMAL SCHOOL, YPSILANTI, MICH.

RAIN falling on the surface of the earth runs off, in part over the surface, causing the streams to swell and overflow their banks; in part soaks rapidly through the ground, under pressure, perhaps, from superadjacent water; and in part seeps or drains out slowly, maintaining the flow of streams in dry weather. In the course of six months' gauging on the Matfield river, near Elmwood, Mass., I have noted some details concerning the relations between these various forms of run-off that are not without geographic interest. Especially worth noting is the great accession of flood waters immediately after the rain has ceased falling. As some of the details may be peculiar and local I give below a brief account of the main features of the basin.

The Matfield is a small river, here about thirty feet wide and two deep, delivering approximately sixty cubic feet of water per second. For about a mile near Elmwood it flows in a valley six hundred feet wide, floored with a flood plain that is fairly under water at the five-foot stage of the gauge. This plain is bounded by bluffs varying from twenty to thirty feet in height. The area of the basin above the gauge is about forty square miles, and there are few points distant so much as a mile and a half from the river or main tributary. The bluffs are grassed over save in a few sites

FIG. 1.

of frequent landslips, but these occupy an insignificant percentage of the whole area. At the foot of the bluffs numerous springs emerge, which swell rapidly during rains and neighboring swamps feed not a few tributary brooks.

* The first paper in this series was published in the JOURNAL OF SCHOOL GEOGRAPHY, June, 1901, p. 238.

The stream is dammed for water power at two points above Elmwood, and the daily flow and nightly storage appears very distinctly at low stages, as will be seen in the diagram of gauge readings for June 9 to 15 (Fig. 1).

The gauge employed was a clapboard with feet and inches painted on it. This was nailed to a post under an old mill near Elmwood Bridge.

Mean water is probably not far from the two-foot mark on the gauge, while at five feet, as has been said, the river leaves its bed and occupies most of the flood plain, the last portions to disappear beneath the water being the narrow strip of natural levee on either margin of the river bed.

The diagrams are almost self-explanatory, carrying height of water on the horizontal lines with numbers right and left, while the verticals give the time in six hour sub-divisions with dates at the top. The heavy curve represents the varying stand of the river surface with short cross-lines to indicate the times of observation that the reader may judge of the personal element present in drawing the curve.

During the week referred to no rain fell and the sky was clear. The water had been falling steadily ever since the heavy rains of late May, checked by a night rain June 7. On the 11th begins the series of daily oscillations that I suppose are due to the daily flow of water through the mill sluices with a somewhat abrupt fall at evening when the sluices are closed for night storage. This recurs at low stages as long as the mills are able to use the water at all. It seems to have no influence on the flood stages shown in other diagrams.

The chief features of flood rise and fall are well marked on the diagrams for May 18-22 and March 21-28, which have been selected as typical. For an hour or so after it begins to rain there is an

FIG. 2.

abrupt rise in the river, continuing, but less abruptly, until a maximum is reached about twenty-four hours after the rain has ceased (Fig. 2). The times of beginning and end of rain are marked

on the diagrams by arrowheads terminating the dotted lines to right and left.

The turbidity represented at the bottom of the diagrams is determined by measuring the depth at which a wire placed horizontal in the water becomes invisible, as suggested in *Irrigation Paper No. 35, of the U. S. Geological Survey*, p. 25, and the scale is that there adopted. As I used copper wire instead of platinum, my observations have no exact relation to that scale, but they plainly have a value among themselves. No such observations of turbidity are capable of much accuracy since the amount and direction of the light constantly vary. Yet the use here made of the measurements is well within their limit of value.

Now these turbidity readings indicate that the water begins to get muddy soon after the beginning of the rain or soon after it begins to rain hard; but unlike the height of water a maximum is reached at the end of the heaviest rain (Fig. 3).

FIG. 3.

I have studied the matter on the spot with some care during and after storms, and suggest the following explanation:

The fall of a hard rain soon makes the street gutters run thick from plowed land and bare roadway surfaces. This soon discolors the surfaces of the river. As the rain diminishes in intensity, the gutter streams rapidly dwindle and presently cease to flow, or carry only a trickle of slow clear water. But the ground is everywhere saturated with water, and its weight forces out the water from the lower layers of ground beside the streams. This occurring over the whole basin maintains the volume poured into the river at a sufficient quantity to increase its rise for many hours more.

The time of this delay of maximum rise after the close of a shower must vary chiefly with the area and topography of the stream basin, though the manner in which the rain falls cannot be without influence. The water of this after-storm rise is progressively clearer and clearer as it comes to the river through the ground with a speed that diminishes as the weight of the water above it lessens, while the muddy water that was still running toward the river in longer brooks

when the rain ceased soon arrives with its burden and ceases to discolor the filtered ground water that continues to rise.

It is altogether probable that the observations of turbidity May 19 and March 21 were not made at the time of maximum.

On beginning this series of observations I had hoped to obtain some curves of storm rise in summer and winter with comparable amounts of rain. Although my departure from Elmwood has prevented the conclusion of the evidence, this much may be said: the Matfield, like most New England streams, is in flood in the spring. That the cause is not heavy spring rains appears from the records of the Weather Bureau (*Ann. Rept.*, 1896-97, p. 358), which when analyzed give New England the following seasonal rainfall:

December to February.....	10"
March to May.....	10.2
June to August.....	11.1
September to November.....	10.8

The spring rains are therefore rather light than heavy. Nor is it wholly due to the ground being in early spring impervious with frost, though this doubtless contributes. Thus the highest stage observed in my series was 6 feet 9 inches on March 11, when there was doubtless frost in the ground. It corresponded to a rainfall of 1.86 inches, but the two rains of March 21 and 26, summing 2.3 inches, produced nearly as great a result after the frost was gone. Equally heavy rains in summer or early fall of the last two years certainly have not lifted the water to the five-foot level since that would have resulted in flooded meadows. I believe that still more important than frost in the ground is the filling of the pores of the ground with water in the spring rains, when evaporation is moderate and the abstraction of water by plant growth has not yet begun. The quantity of water that can be stored in the soil is very great. This is evident on considering the amount yielded up to the rivers, maintaining their flow between rains. If the pores of the soil in which rain falls be empty a considerable downpour may find immediate storage in the ground and produce little effect on the streams. And during fall and summer the two forms of evaporation are so active that an empty condition of the soil interstices must often be approached. Measures of evaporation from the ground are not satisfactory, but the amount is certainly larger in hot weather. According to the *1894 Year Book of the Department of Agriculture*,

p. 174, a crop of hay in growing abstracts from the ground more than the equivalent of five inches of rain, or nearly half of all that falls in the growing season. L. H. Bailey, in his "Botany," p. 82, puts an estimate on the amount of water that needs to pass through each ounce of dried vegetable matter during its period of growth, which implies from eight to twenty inches of rain thus used. I believe these two drains on the soil in summer cause the absence of summer floods.

One of the most carefully studied basins in New England is that of Lake Cochichuate, *Irrigation Paper* No. 35, p. 38. From 36 years of observation it appears that the run-off in the streams is 26.72 inches less than the rainfall in the whole year, because of various forms of evaporation; and eleven inches, or 41 per cent. of all of it occurs in the less than four months of summer growth.

IRRIGATION METHODS *

BY GEORGE B. HOLLISTER, RESIDENT HYDROGRAPHER, U. S. G. S.,
RUTHERFORD, N. J.

IRRIGATION, which is yearly becoming a more important factor in the industrial development of the country, presents many interesting features in its practical application. The intelligent dweller in the humid regions, who has not had the advantage of travel into the arid sections of the country, knows in a general way what irrigation is and comprehends its broader results. But few, perhaps, understand the actual processes by which a desert and almost worthless tract of land is reclaimed by the application of water and in a few seasons covered with a growth of luxuriant vegetation and made to yield not one, but several crops a year. Yet this process has been going on for fifty years or more in the western part of our country, until, as we find by the official figures in 1900, 7,500,000 acres had been thus brought under cultivation. It would be interesting to compare the statistics further and discover what this vast acreage means in increase of land values and taxable property, in the production of valuable commodities, in growing population, in sociological and political influence, and in

* Illustrations by courtesy of the U. S. Geological Survey.