probably a quarter of a mile long. The gully opened a new course to the river and, a mile below at the village of Whitesville, the remains of the structures were found, so utterly demolished as to be unrecognizable even to their former owners.

Many places have been damaged in the past and some destroyed because a dam failed; here was one which suffered because the dam held.

The village of Cavendish is situated on the north margin of the flood-plain of the Black River, which rises in the mountains and flows in a generally southeasterly course to its confluence with the Connecticut. The valley is perhaps half a mile wide at the village. Just east a large hill rises dividing the valley into two branches. The river flows through the south branch, where it has been dammed; while the highway in question ran through the north branch to Amsden, Ascutneyville and the Connecticut River. A dike in the valley, west of the hill, protected Cavendish from the impounded river water, while a storm-sewer laid under the highway drained the surface water down past the hill, where it could join the river. When the flood came the dam held fast but the dike broke and the sewer sections probably became loosened and carried away, thus enabling the flood waters to erode both above and below the highway with the disastrous results noted.

The great gully, eroded down to an easterly-sloping, gneissic bedrock, reveals the pre-glacial channel of the river, showing striations, chatter marks and pool-basins at the foot of the old rapids. The retreat of the ice-sheet filled the valley with till and impounded a lake whose terraces are in evidence for several miles up the valley. Later the river found a new outlet, this time to the south of the hill mentioned, and its old hidden course became a highway.

And so, unwittingly, the villagers built their houses "upon the sand" and the floods have borne out the truth of the old parable as they probably have been doing ever since it was uttered.

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ILLUSTRATIONS WHICH DO NOT ILLUMINATE THE PROBLEM

IN a recent issue of SCIENCE (November 4, 1927), Dr. R. G. Aitken, associate director of the Lick Observatory, contributes an article entitled "Old Problems with new Illustrations" in which certain statements of recent astronomical observations have been somewhat peremptorily challenged. The name of none of the offenders is mentioned, yet, in one case, the quotations used coincide verbatim with sentences in a recent article of mine, "Island Universes" (*Natural History,* Vol. 26, 286, 1926, and Harvard College Observatory Reprint No. 32). Dr. Aitken furnishes additional identification marks showing that the quotations are from my article. In view of this I feel justified in trespassing upon the columns of SCIENCE in order to present the facts of the case.

Four points are specifically brought up by Dr. Aitken.

1. The total number of stars in the Galactic system is put down in my article as "about fifty billion," whereas Dr. Aitken says that, "according to the most careful and reliable investigation so far made" this total number is very hesitatingly put at thirty billion. There is good evidence that the fraction of all the stars in space which are visible even with the greatest telescopes is probably in the neighborhood of one or two per cent. The estimated total therefore involves great extrapolation. In describing the results in a popular article, where, as is evident, the argument requires an upper limit for this total number of stars, the use of fifty billion instead of thirty billion is not only justified by its practical equivalence, but it is almost necessary.

2. An objection is made against my statement that a star may be a thousand times as large as the sun in diameter. The facts are, as Dr. Aitken says, that the largest measured diameter is certainly not more than half, and possibly not more than one third of this value.

In 1906 Hertzsprung published a formula for predicting the angular diameter of a star when the color and the apparent magnitude are known. When in 1920 the first stellar diameters were measured, they proved to agree within thirty per cent., which, I am sure, astronomers generally regard as an excellent agreement in the case of such pioneer work. We may then perhaps be allowed to consider the formula used by Hertzsprung as well established, and use it, to extend our values to other stars which had hitherto fallen outside the region of calculations. In Harvard Reprint 25 and Harvard Circular 271, 1925, Shapley cites the existence of some very red stars in the Magellanic Clouds which, on the basis of the formula predicting stellar diameters would have linear diameters of the order of magnitude of 10^9 kilometers, the sun's diameter being 1.4×10^6 kilometers. Here I should say that I can not satisfy the reader who looks for an exact statement to the nearest million miles; round numbers, which imply large uncertainties, are more to my liking.

3. I am accused of having remarked "blithely" that "fifty billion years is but a short interval in the life of an average star." I should indeed be most grateful to Dr. Aitken if he could produce any valid arguments to the contrary. Recent papers on stellar ages mention figures of the order of 10^{13} to 10^{15} years,

compared with which 5×10^{10} is indeed a short interval.

4. I wrote: "Observations with the spectroscope made *principally* at the Lowell and Mt. Wilson Observatories have shown us that the Andromeda Nebula is approaching us with a speed of 200 miles a second, the Magellanic Clouds are receding from us at the rate of 176 miles per second." It seems inconceivable that any one would be able to read into this sentence the meaning that "the Magellanic Clouds *have recently moved so far north* (italics mine) that their radial velocities can be and have been measured from Mt. Wilson and Flagstaff." The radial velocities of these objects were actually observed at the Chilean station of the Lick Observatory, which might well have been mentioned.

Summing up, I should say that I entirely agree with Dr. Aitken that the writer of a popular article owes it to his readers not to make overbold statements. However, one must consider that in writing a popular article, one can not stop to explain all side issues, by footnote or reference, in the same way as is done in scientific articles; such points are essentially matters of personal judgment.

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ORIGIN OF THE PRAIRIE

PROFESSOR PHILIP M. JONES in SCIENCE for October 7 (Vol. LXVI, No. 1710) suggests as a theory for the origin of prairies in the Middle West "rapid drainage at the close of the ice age."

It is doubtful if this theory, or any other relying upon a single factor, can explain very extensive grassland areas, either in the Middle West or elsewhere.

Treeless areas tend to develop in arid or semiarid regions, or where, even though there may be abundant rainfall, the water table is low by reason of unusually free subsurface drainage. In the latter instance, if indeed not in the former, the presence of a large number of grazing and browsing animals is an important factor. Starting on such "negative oases" these animals are apparently able to beat back the line of forest, even into regions where moisture conditions are not unfavorable to tree growth.

Such a region, apparently, one lying entirely outside of the glaciated district, was that which may be roughly defined as the portion of southern Kentucky and northern Tennessee lying between the Green and Cumberland Rivers. It also extended into southern Illinois. When first visited by white men it was treeless and covered with grass. The writer has seen in a collection of old maps in the Boston library one of this middle western country printed by John Sinex in Amsterdam, Holland (no date, but presumably in 1721) on which this region is designated as the place "where the Illinois hunt cows." This map is evidently a reproduction of an earlier one in which the legends were in French and where the word rendered "cows" in the later edition was undoubtedly "beufs" in the former. A proper rendition of the original inscription is therefore, "where the Illinois (Indians) hunt buffalo." The first description of this country brought back to English colonists of the Atlantic seaboard, was by a party of hunters, led by a German by the name of Casper Mansker, which setting out from North Carolina in 1769 (See Haywood's History of Tennessee) first broke out of the forest in what is now Wayne County, Kentucky, and there saw stretching toward the west a vast expanse of treeless upland, covered with grass, and grazing countless numbers of buffalo, deer and elk. Not yet having been introduced to the French word "prairie" as descriptive of such a region, these hunters called it "meadow land," and a creek at the headwaters of which by a spring they camped, "Meadow Creek." This creek, sinking a short distance below the spring, reappears again, only to plunge by steep descent into the gorge of the Cumberland River. It still bears the name "Meadow Creek." So excellent was the hunting here, and so eager were the hunters to enrich themselves with skins and pelts that they forgot to return to their homes and families in North Carolina for two years. For this when they did return they received the name "The Long Hunters."

When finally opened up for settlement this region was largely "passed up" by the early pioneers as "poor land," in accordance with the mistaken notion of persons acquainted only with the wooded country to the east that a soil that was not supporting trees must be poor indeed. Hence the name "Barrens," by which the region became known by the early part of eighteen hundred, when the Kentucky legislatures of that period wrestled much with the problem of inducing its settlement. One of the offers made to prospective settlers was the remission of taxes for a certain period of years. The early name for the region is still perpetuated in Big and Little Barren Rivers, and in Barren County, Kentucky, situated near the center of the area.

A geologic examination shows the Barrens to have been nearly coextensive with the outcrop of the cavernous limestone of the Mississippian series. It is a karst country abounding in sinks and caves and underground channels through which rain-water readily sinks and finds its way speedily into the major streams of the region. Hence it suffers much in times of drought. Hence also it would appear, that, aided possibly by forest fires, vast herds of buffalo and deer and elk were able to reclaim it from forest and