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THE ACCRETION OF FLOOD PLAINS BY MEANS OF SAND BARS.

BY HOWARD E. SIMPSON.

About one-half mile above the confluence of the Iowa and Cedar rivers, the Iowa makes a great bend from a southwesterly to a southeasterly direction. The river on the outside of this curve is rapidly cutting at the base of a high bluff for a distance of about one-third of a mile. The bluff extends beyond at each end, bounding the flood plain, but at some distance from the stream. The bluff is composed chiefly of Kansan drift overlain by Iowan loess, which creeps rapidly riverward when saturated with water.

Opposite the bluff the broad flood-plain and level "bottoms" extend away eastward to the drift hills beyond the Cedar and to the northward merge into the sandy floor of ancient Lake Calvin.

The work of the river in cutting down the higher land and widening its flood plain is plainly shown on the face of the bluff where the process has been very rapid during the past season. Many yellow scars indicate the creep of land rapid enough to cause landslips, and at intervals masses of soil fall into the water and are carried away by the current, a single mass having carried four oak trees rooted in it.

Farther evidence of the retreat of the bluff may be found at the summit, where the very edge forms the divide between the river and its tributary, Short creek, so great has been the shifting. An Indian burial mound known in local tradition as "The Grave of Osceola's Queen," has practically disappeared within the memory of living set-

tlers and the charred trunk of an ancient oak, a well known landmark, now stands with roots half in air.

Two years ago last September the peculiar form of an island, near the inner side of this bend, attracted my attention. It was perhaps 230 feet long, crescent shaped, with points turning toward the flood plain side. A heavy growth of willows covered the main portion, indicating in a general way the age of the island. These dwindled away toward the lower end and the points of the crescent were of soft newly deposited silt. A very slow drift of water was noticeable on the inner side while on the outer, well over toward the base of the bluff, swept the main current.

Observing this island in the following May, it was found that the horns had grown to such an extent that they were both connected with the inner bank and entirely enclosed a small lagoon of stagnant water. In October, 1901, one year after the first observation, the lagoon had entirely disappeared and a barren strip of sand marked its former position. The willow covered island was now a part of the flood plain. The process was probably hastened by the extreme drought of the season and the consequent low stage of water in the river.

The past spring of 1902 found grass and weeds growing over the greater portion of the former lagoon, and all trace of former island would soon have been lost in flood plain had not the excessive rains of last July and August flooded the bottom lands and removed a small amount of the filling of the old inner channel, leaving a small, stagnant pool, surrounded with the tangled growth of willows and weeds of the flood plain.

Observations on other islands in the Iowa and Cedar rivers, and in the Mississippi between Lansing and Muscatine, lead me to believe that this island is not a peculiar form, but a type which is well defined and frequent enough in occurrence to deserve recognition. The history of its development from sand bar and flood plain may be sketched in the following three stages.

A lodged snag or other obstacle in any well loaded stream may check the current, leaving a small area of com-

paratively quiet water on the down stream side. Around and into this from each side come eddies, bearing sediment in suspension which lose their swiftness, drop their load and thereby start a sand bar. This bar develops by additions mainly on the down stream end, but also on both sides.

The deflection of the current by the obstruction turns the stronger current slightly against shore and tends to start a meander, leaving the island on inner side of curve and increasing deposit.

The swifter eddy swinging from the side of the stronger current, deposits in a curve from the lower end and shoreward on the opposite side. A tendency to stagnation, therefore, results on that side and causes a deposit in a curve from the upper end along the edge of the current. The sand bar thus becomes crescent shaped and the first stage is ended.

In the second stage the silting goes on rapidly until the horns of the crescent reach the shore and enclose a lagoon of stagnant water.

During the third and last stage the lagoon is filled up as are other flood plain lakes, by direct deposit of sediment from winds and high water, and by plant encroachment, until all trace of the lagoon is lost and the island has been added to the flood plain.

The study of the single island, together with the observations on others in all stages of the process described leads us to the conclusion that it is a type common to valley and plain tracts of rivers, and that flood plains receive definite accretions by means of sand bars.