

OBSERVATIONS ON THE EFFECTS OF EROSION ON THE ECOLOGY AND MAINTENANCE OF AN ARTIFICIAL LAKE IN LOGAN COUNTY, OKLAHOMA

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In the fall of 1930, twenty-five faculty members of Central State Teachers College at Edmond, Oklahoma, organized a corporation known as the Central Country Club. This club purchased a school-land, preference right lease on 160 acres, five miles due north of Edmond and just across the line in Logan County. On this acreage, they constructed a cabin and a dam for impounding a small lake. In constructing the lake, expert advice was obtained from A. and M. College, the Fish and Game Commission, and men who had successfully established lakes. The engineering advice was good and a lake of some eight or nine acres resulted. It is with the subsequent history of this lake that I wish to deal.

The emphasis placed by the national administration upon flood control, soil conservation, etc., has done much to encourage the construction of lakes and ponds throughout the countryside. Many government agencies are assisting in these programs but in many of these projects two things are frequently overlooked or under-emphasized. These are: the colloidal suspension in the water and the proper disposal of excess water during flood stages. The lake in question illustrates these points nicely.

This lake was constructed at the union of two small, spring fed creeks. These streams drained some two sections of land, most of it overgrazed pasture. Both streams flowed through a typical oak, hickory, elm, flood plain association. Adjacent to the lake the land had been cultivated and no terracing had been done. The soil was a loose sandy loam, and in places was badly gullied. During the time since the lake was established, very little cultivation has been done in these fields and terraces have turned the excess water into the creek below the dam.

All the trees and underbrush were cleared out of the basin destined to form the floor of the lake. The spillway was constructed on the west side of the dam where the excess water would pass through a grove of large trees and empty into the creek bed some hundred yards below the dam. The water in the lake at its deepest point was about twenty feet deep. Thus, any water passing over the spillway must drop an average of one foot for every fifteen feet in progressing downstream. Our advisors neglected to call our attention to this matter.

When the spring and fall rains came the lake soon filled and the excess water rushed around the spillway and down to the creekbed below, taking with it enormous quantities of earth and sand. Within three years the spillway had become a small canyon at its lower end and some of us began to be concerned. Two years later, even with the drouth year of 1934, the canyon had been cut back half way to the dam and something had to be done. As is usual in club groups, "George" was left to do it, so that in the fall of 1936, after a four-inch downpour, it was found necessary to raise and reconstruct the dam and build new spillways.

It is almost impossible to conceive of the tremendous cutting power of such a stream. In a single night, a canyon some ten or twelve feet deep, fully as wide, and a hundred feet long was gouged out of the earth and rock. Trees were uprooted and rocks worn away in the waters' mad rush.

Expense and lack of interest prevented the proper construction of concrete aprons, etc., in the building of the new spillways. The slope was decreased to about six inches every ten feet. In one year, a ditch twelve feet deep has been cut back through the woods for thirty yards. The tremendous effect these chasms have on the vegetation and animal life in the adjacent timber and stream can well be imagined.

In the body of the lake itself, other difficulties appeared. The small streams during most of the year were clear and constant, but when spring or fall floods came, they were filled with a colloidal red mud. As a result, the lake was constantly muddy. Visibility on a white porcelain disc was very seldom more than twelve inches. Various measures were undertaken to combat this condition but to no avail. Plant barriers were planted upstream. Coontail, Chara and other water plants were planted by the boatload. The water plants were soon choked out and brush had little effect in sedimenting colloidal material.

Likewise, the mud and sand carried down the stream beds were soon deposited in the upper ends of the lake. Again it is difficult to conceive of the enormous amounts of sediment carried by these streams.

The effects of these erosive changes on the ecology within the lake and below it are quite interesting. The author neglected a wonderful opportunity to collect quantitative and qualitative data during these years but perhaps these cursory observations may have some value.

Within the lake itself, there is little or no floating or submerged vegetation or animal life due to the colloidal mud in the water. This particular stage in the succession on the mud and sand bars is almost entirely lacking. In some places the "primrose willow" serves as the pioneer, forming a rather dense semi-floating covering over the bare mud. In the moist and swampy areas of the deltas and mud flats, the cattails form dense masses. The drier portions of the sand bars support cottonwood and button-bush thickets. Around the lake shore proper, the willows and the button-bushes seem to dominate the new order. Behind them, as one leaves the shore, comes the tall blue stem, sumac and then the Black Jack and its associated forms.

Along the dam on the upstream side, there has recently appeared considerable quantities of *Equisetum*. Just what part this may play in the succession is not clear. The dam has over it a good sod of bermuda grass and the *Equisetum* seems to be surviving its competition successfully. Downstream, below where the spillways empty their loads, there is found a bank of the creek covered with a dense mat of *Equisetum*. This mass of vegetation seems to be growing vertically, as well as horizontally, and it now extends back some distance from the edge of the bank proper. The effect of the flood waters from the spillways seems to be, if anything, favorable.

In the old spillway channel, the mosses and lichens are covering the denuded floor very rapidly and in the moist sandy areas, cattails are putting in an appearance. In the shaded, drier areas of the canyon, cottonwood, redbud, and greenbrier are forming dense thickets.

In summary, it is hoped that those persons constructing lakes may profit by our experience and consider that the proper disposal of excess water (spillways) is a most important feature. It must also be recognized that the colloidal and chemical nature of the soil from which the drainage comes will determine the water plants which can survive—and through them the success or failure of the piscatorial pastime.