A Fourth Report on the Accumulation of Recent Alluvium in Deep Fork of the North Canadian River Valley in Lincoln County, Oklahoma

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Three previous reports (1, 2, 3) have been published on the harmful effect of recent alluvium on tree development and crop production in Deep Fork of the North Canadian river valley in east central Oklahoma. The channel of this stream was very tortuous under natural conditions. Bottomlands were fertile, but flood hazards were severe during the spring months. Consequently, a drainage ditch was started near the Creek-Lincoln county line and extended westward to a point near the center of Oklahoma county to reduce the harmful effect of flood water on crop production in this part of the stream valley. Construction on this ditch began in 1912 and was completed in March, 1923. Water movement in the drainage ditch was accelerated as compared with the rate of flow in the old stream channel. Therefore, sand, silt, and clay, washed from sloping cultivated fields on the uplands, and driftwood carried by flood water developed log jams and deep deposits of alluvium in the tortuous channel and on the bottomlands of this stream in the western part of Creek county, a short distance downstream from the end of the drainage ditch. These deposits gradually raised the elevation of the flood plain in some parts of the valley more than 10 feet. Shallow lakes were formed on the upstream side of natural levees in some areas.

The rapid deposition of alluvium combined with a raise in the level of the water table destroyed the pecan, oak, and elm trees which were present on the bottom land, and willow, cottonwood, and ash thickets appeared on much of the newly-deposited sediments. Several roads across this stream have been closed because bridges were destroyed by the combined effect of log jams and flood water, or because the roads were covered with water or deep deposits of sand and silt.

The valley gradient of Deep Fork in the eastern part of Lincoln county was originally about three feet per mile. Consequently, a fill of nine feet across the valley would form a pond for three miles upstream, which would create a favorable condition for the deposition of sediment carried by flood water. It would be necessary for the entire upstream valley to be filled with sediment to a depth of nine feet to reestablish a gradient of three feet per mile in that part of the valley where such a gradient originally prevailed, unless retrenching occurs rapidly enough to change the sedimentation pattern which has been established in this part of the stream valley. In 1938 very little silt had been deposited on the flood plain of Deep Fork north and west of a line between Sections 14 and 23, T. 14 N., R. 6 E. This location is in Lincoln county, Oklahoma, east of the old Sac and Fox Indian school. From 1938 to 1943, upstream siltation continued for a distance of 4.5 miles; and the depth of the alluvium was sufficient to destroy valuable pecan and other trees to a point about 1,000 feet north of the southeast corner of Sec. 20, T. 14 N., R. 6 E., in Lincoln county. From 1943 to 1948, harmful siltation had covered the bottom land upstream from previous observations to a point about 3/4 mile west and 1/4 mile north of the southeast corner of Sec. 31, T. 14 N., R. 3 E., in Lincoln county. This was 3.5 miles from the point where serious damage to natural tree growth and cultivated land was observed in 1943. From 1948 to 1953, deep deposits of sand and finer sediments had covered the bottom land for a distance of 2.6 miles farther upstream to a point near the north center of Sec. 2, T. 13 N., R. 5 E., and extending across the southeast quarter of

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Sec. 35, T. 14 N., R. 5 E. Much damage also has occurred to bottomland along tributaries to Deep Fork in this area.

Permanent bench marks were established at several points adjacent to the Deep Fork drainage ditch in 1943 to study the effect of siltation on changes in the vertical distance between a low-water stage in the stream channel and the surface of adjacent bottomland. Data on differences in elevation between low-water flow in the stream and the adjacent flood plain for locations measured in 1943, 1948, and 1953 are given in Table 1.

These data show that the Deep Fork drainage ditch is being filled with sand at all points measured. In the eastern part of this area, sediments have accumulated in sufficient quantity so that the surface of the water in the drainage ditch at low-water flow is several feet above the original soil in the stream valley. In many places the dikes along each side of the drainage ditch have been destroyed by stream bank erosion. Consequently, bottomlands adjacent to these areas are flooded by a small increase in stream flow.

The total acreage of land damaged by recent alluvium in the Deep Fork valley in Creek and Lincoln counties prior to 1938 was about 2800 acres. The area deeply covered with silt in Lincoln county from 1938 to 1943 was approximately 2900 acres; from 1943 to 1948, 1200 acres; and from 1948 to 1953, 1600 acres. These results were obtained from planimeter measurements on aerial photographs.

The average annual rainfall at Chandler, Meeker, and east Oklahoma City for the three five-year periods reported in Table 1 has been similar to, or slightly above the long-time average for each of these stations. These averages are as follows: Chandler, 33.87 inches; Meeker, 34.88 inches; and east Oklahoma City, about 31.0 inches. More bottom land along Deep Fork will be severely damaged by excessive silting and flooding before a stream gradient has developed which will be favorable for stream flow to develop a deeper channel.

Some retrenching of the Deep Fork channel has begun in the eastern part of the silted area in Creek county. Measurements should be taken to follow the future rate of stream-channel development in this area. Eventually a narrow flood plain may develop in this part of the valley at a lower elevation than that of the present flood plain. When this condition occurs, flood hazards in the eastern part of the deeply-silted area should be less than those which existed prior to the construction of the drainage ditch.

Literature Cited

1. Harper, Horace J. 1938. The effect of silting in tree development in the flood plain of Deep Fork of the North Canadian River in Creek county. Okla. Acad. Sci. Proc. 18:46-49.

2. Harper, Horace J., and Rose, Lonnie E. 1944. Effect of silt on natural vegetation and drainage in the flood plain of Deep Fork of the North Canadian River in Lincoln county, Oklahoma. Okla. Acad. Sci. Proc. 24:80-82.

3. Harper, Horace J., and Garman, William L. 1949. Further studies on the flood plain of Deep Fork of the North Canadian River, Lincoln county Oklahoma. Okla. Acad. Sci. Proc. 29:56-59.

TABLE 1

Effect of silting on changes in the elevation between the stream bed of the Deep Fork drainage ditch and the adjacent flood plain in the eastern part of Lincoln county, Oklahoma.

No.	Location	Year and depth of stream bed in feet below flood plain		
		1943	1948	1953
1*	NW¼ 33, T 14 N, R 4 E	10.89	7.90	6.65
2	NW¼ 34, T 14 N, R 4 E	9.45	8.08	7.33
3	NW¼ 35, T 14 N, R 4 E	6.81	5.14	3.09
4	SE¼ 36, T 14 N, R 4 E	8.87	5.09	3.44
5	SW¼ 5, T 13 N, R 5 E	9.48	7.18	5.07
6	NE¼ 10, T 13 N, R 5 E	9.48	5.45	4.63
7	NW¼ 5, T 13 N, R 6 E	6.80	7.80***	3.39
8	NW¼ 28, T 14 N, R 6 E	3.20	.22**	2.68**
9	SW¼ 15, T 15 N, R 6 E	2.99	3.00**	5.10**
10	NE¼ 15, T 14 N, R 6 E	3.55**	.....	.....
11	SW¼ 11, T 14 N, R 6 E	1.96**	.....	.....

* Bridge on State Highway No. 18, south of Chandler, Oklahoma.
** Water in stream channel higher than old flood plain.
*** 4.1 feet of recent alluvium over the buried soil.