FURTHER STUDIES ON THE RECENT ACCUMULATION OF ALLUVIUM IN THE FLOOD PLAINS OF DEEP FORK OF THE NORTH CANADIAN RIVER, LINCOLN COUNTY, OKLAHOMA

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Two previous papers (Harper 1938, 1943) have been presented on the effect of recent alluvium on soil and vegetative conditions in the flood plain of the Deep Fork of the North Canadian River in Oklahoma. During the 15 year period from 1923 to 1938 approximately 10 feet of alluvium was deposited on the flood plain of Deep Fork in the southwestern part of Creek County. This natural mud dam developed immediately east of the end of a drainage ditch which stopped at the Lincoln-Creek county line. Silting in this area has been a gradual process and several large lakes have been

FIGURE 1. Improved Pecan Grove Killed by Silting and Flooding

formed behind a natural levee along the stream channel. These lakes are slowly filling with clay. In 1943 a second study revealed that 2,800 acres of bottomland along Deep Fork in eastern Lincoln County had been covered by recent alluvium, and that a large acreage of timber containing a high percentage of pecan trees had been destroyed.

The gradient of the flood plain in this area was about 2.9 feet per mile before the Deep Fork drainage ditch was constructed. If a change in gradient was the only factor affecting the accumulation of sediment above the natural mud dam which developed in Creek County, silting should not continue to accumulate at a rapid rate much farther upstream than 10 miles. This would permit the reestablishment of a flood plain gradient of approximately two feet per mile which is about one-third less than the original gradient in this area. However, it is much higher than the gradient along this stream in eastern Creek and Okmulgee counties.

Two factors which may retard the development of the normal sedimentation pattern which prevailed before the Deep Fork drainage ditch was constructed are, (1) the development of a dense growth of willows, ash and cottonwood, which replaced the large trees composed principally of pecan, oak and elm on the silted areas, and (2) the increase in the quantity of sediment which is being transported as a result of an increase in velocity of the water caused by the straightening of the stream channel. Since a dense growth of vegetation retards the flow of flood water and the larger particles carried in suspension are deposited in these areas it is quite possible that this condition will not change appreciably until subsurface drainage is improved by a natural or artificial deepening of the stream channel. This would permit the return of the larger trees originally present, and they should have less influence on the movement of flood water. Severe floods commonly occurred in the Deep Fork valley before the drainage ditch was constructed; however, there was no rapid accumulation of alluvium on the flood plain. Since the drainage ditch was constructed the quantity of sand and silt carried by flood water has increased because of the higher velocity of the water flowing in the stream channel. Stream bank erosion has widened the channel and in many places has destroyed the levee built on each side of the channel when the ditch was dug. This levee protected adjacent bottomlands from moderate floods for several years after the drainage ditch was completed. Large quantities of sand have been deposited on the adjacent flood plain during recent years of flood water flowing through breaks in the levee. In some places these deposits have filled the valley between the stream channel and the adjacent upland. Two large lakes have been formed during the past three years by a thirty inch layer of sandy alluvium extending from the stream channel to the adjacent upland in the southeast part of Section 31, Twp. 14N, R6E, Lincoln County.

In September, 1943 several measurements were made to determine the difference in elevation between the bottom of the Deep Fork channel and the adjacent flood plain. This information was published in a previous report (Harper 1943). Similar measurements were made in November, 1948 at the locations studied in 1943. Very little water was flowing in the stream channel when these measurements were made. From one-half to two-thirds of the stream bed was exposed except in those areas where down-stream silting had retarded the flow, and the stream bed was covered with water. A comparison of the difference in elevation between the water line in the channel and the adjacent flood plain of Deep Fork in 1943 and in 1948 is given in Table I. Measurements were obtained in 1948 at all points studied in 1943 except at Station 12, where the accumulation of alluvium has been very similar to that at Station 11. The difference in elevation between the water line in the stream channel and the adjacent flood plain in 1948 varied from approximately 1½ to 4 feet less than in 1943 except at Station 1, where the channel was 1.73 feet deeper in 1948 than in 1943. Scouring has occurred in the drainage ditch immediately west of this point and the channel has been deepened consid-

erably since it was constructed. No measureable amount of recent alluvium has accumulated on the flood plain at Stations 1 to 7, inclusive. The depth of recent alluvium was determined at Stations 8 to 11 by digging until the dark colored surface of the former flood plain was encountered. In 1943 deep deposits of silt had accumulated at Stations 11 and 12 and a few inches had accumulated at Station 10. No silting had occurred at Stations 8 and 9 at this time.

TABLE I

Effect of silting on changes in elevation between the stream bed and the flood plain of the Deep Fork Drainage Ditch in the eastern part of Lincoln County, Oklahoma.

No.	Location	Depth in Feet Below Adjacent Flood Plain		Depth of Recent Alluvium
		1943	1948	1948
1	NW¼ Sec. 24, T. 14N, R3E	8.00	9.73	
2	NW¼ Sec. 33, T. 14N, R4E	10.89	7.40	
3	NW¼ Sec. 34, T. 14N, R4E	9.45	8.08	
4	NW¼ Sec. 35, T. 14N, R4E	6.81	5.14	
5	SE ¼ Sec. 36, T. 14N, R4E	8.87	5.09	
6	SW ¼ Sec. 5, T. 13N, R5E	9.48	7.18	
7	NE ¼ Sec. 10, T. 13N, R5E	9.48	5.45	
8	NW¼ Sec. 5, T. 13N, R5E	6.80	7.80	4.10
9	NW¼ Sec. 28, T. 14N, R6E	3.20	1.49	1.71*
10	SW ¼ Sec. 15, T. 14N, R6E	2.99	.00	3.00**
11	NE ¼ Sec. 15, T. 14N, R6E	3.55***	3.16	4.80
12	SW ¼ Sec. 11, T. 14N, R6E	1.96***	—	

During the past five years the silt deposits have continued to accumulate upstream from a line approximately 80 rods north of the south side of Sections 20 and 21 to the south center of Sec. 31, Twp. 14N, R6E, Lincoln County. Figure 1 shows an improved pecan grove occurring in the northeast quarter of Sec. 32 in this area, which was killed in 1948 by silting and flooding. A dense growth of willow, ash and cottonwood will soon appear on that portion of the silted area where water does not stand during a major portion of the growing season.

No permanent bench marks were located when the 1943 measurements were made. In 1948 permanent bench marks were established at the various stations, using abutments of bridges, concrete piers, steel pipes set vertically in the ground and nails driven into large trees. Future changes will be determined by using these reference points to measure differences in the elevation between the bottom of the stream channel and the adjacent flood plain.

The depth of the recent alluvium was less at Station 9 than at Station 8 in 1948 because the levee on the east side of the creek at this point is still holding back most of the flood water. However, the water line in the stream channel is slightly higher than the old flood plain. More than four feet of recent alluvium has been deposited over a wide area on the west side of the stream channel at this point.

Measurements made to determine the distance upstream from the Lincoln-Creek county line to a point where sediment had accumulated in sufficient quantity prior to 1943 to kill the original timber on the flood plain indicate

* 4.38' on west side of creek.

** Natural levee of sandy material about 6 feet deep developed here. Alluvium was measured where clay was deposited in a back-water area, 600' SE of steel bridge.

*** Heavy silting in this area on each side of stream channel in 1943. Levee destroyed and water level about 2 feet above original soil in valley.

that an area 7.7 miles long had been affected. Between 1943 and 1948 sediments varying from 3 to 6 feet in depth have been deposited upstream for a distance of 3.5 miles. The total distance from the point where a deep accumulation of silt began in Creek County to the south center of Sec. 31, Twp. 14N, R6E, which is the upper end of the silted area at the present time, is over 13 miles. Large quantities of sand are being deposited on the flood plain in the northeast quarter of Sec. 10 and the southeast quarter of Sec. 3 (T. 13N, R5E) which is four miles upstream from the point where deep deposits of silt have filled the entire stream valley. A break in the levee near the west side of Sec. 6 (T13N, R6E) is responsible for the accumulation of a large quantity of sand in that area, and eventually the extension of this deposit to the adjacent upland will create a severe flood hazard on a large area of cultivated bottomland near the junction of Robinson Creek and Deep Fork.

Several small tributaries to Deep Fork in this area have been affected by silt accumulation. Silting has extended southward in the Deer Creek valley across Sec. 33. Increased flood hazards are normally a more serious problem in these areas than accelerated silt accumulation.

This study reveals that recent alluvium has been deposited on the flood plain of Deep Fork of the North Canadian River in eastern Lincoln County at a rapid rate and that *twelve hundred additional* acres of land have been covered with sediment to the depth of several feet during the past five year period. The productive value of the silted area has been destroyed, and it cannot be increased until the rate of silting declines and internal drainage conditions improve so that pecan trees can be reestablished on the area. The deep deposits of clay will be unfavorable for the growth of valuable trees or other vegetation for a long period of time.

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