A Fifth Report on the Accumulation of Recent Alluvium in Deep Fork of the North Canadian River Valley in Lincoln County, Oklahoma[1]

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Four previous reports (Harper, 1938: Harper and Rose, 1944; Harper and Garman, 1949; Harper and Gray, 1954) contain information on the destructive effect of deep deposits of recent alluvium on tree development and crop production in Deep Fork of the North Canadian River Valley in east-central Oklahoma. Rapid sedimentation began immediately east of

[1] Contribution from the Oklahoma Agricultural Experiment Station, Stillwater, Oklahoma.

the Lincoln-Creek County line after a drainage ditch in the Deep Fork valley was dug across Lincoln County and into central Oklahoma County during the eleven-year period from 1912 to 1923. This improvement hastened the removal of floodwater from the ditched area, but it also increased the quantity of suspended material in the stream during flood stages.

Log jams collected beyond the east end of the drainage ditch in the Deep Fork channel immediately east of the Lincoln-Creek County line and decreased the flow of flood water. Consequently, a rapid accumulation of alluvium in this area filled the stream channel and raised the level of the adjacent floodplain more than 10 feet. This natural earth dam retarded the upstream flow of flood water for a distance of approximately 3 miles.

A thick growth of willow, ash, and cottonwood quickly appeared on the sandy alluvium where native trees had been killed by the combined effect of deep silting and a rise in the water table. These small trees contributed to the accumulation of sediment by retarding the flow of flood water before it reached the ponded areas. This effect caused an upstream movement of the deeply-silted area. Several lakes were formed at the outer edges of the Deep Fork valley where flood water was impounded behind natural levees. Silty clay sediments have accumulated to a depth of several feet on the original flood plain in these areas.

A deep deposit of alluvium was observed on the Deep Fork flood plain in the western part of Creek County and in the eastern part of Lincoln County before 1938, but no measurements were made on the rate of silt accumulation prior to this date. The deeply silted area advanced upstream about 6.5 miles from the east side of section 34, T. 14 N., R. 7 E. in Creek County from 1923 to 1938. A further extension of approximately 4½ miles occurred from 1939 to 1943; 3.5 miles from 1944 to 1948; 2.6 miles from 1949 to 1953; and 1.5 miles from 1954 to 1958. The progressive upstream movement of the deeply-silted area is shown in Figure 1 by 5-year periods since 1938.

PROGRESSIVE SILTING OF DEEP FORK VALLEY IN CREEK AND LINCOLN COUNTIES IN OKLAHOMA, 1923 - 1958

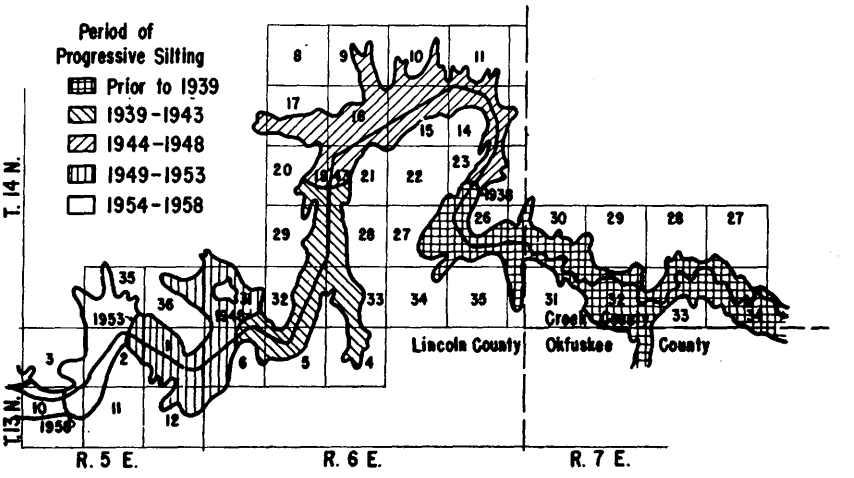

FIGURE 1

Variation in seasonal rainfall may have been partly responsible for observed differences in the rate of sedimentation in this valley. Data on the average annual rainfall on the upper part of the Deep Fork watershed by 5-year periods from 1939 to 1957 are shown in Table I. The average annual rainfall was very similar for the first two of these four five-year periods. However, it was about five inches lower from 1949 to 1953 and 8 inches lower from 1954 to 1957 when compared with the 38-inch average annual rainfall from 1939 to 1948.

Table I. Average rainfall for five-year periods at four locations on or near the upper part of the Deep Fork watershed.

Period	Location and average annual rainfall in inches			
	Chandler	Guthrie	Meeker	Oklahoma City
1939-1943	39.22	33.97	37.70	33.18
1944-1948	36.35	29.17	42.50	36.55
1949-1953	34.28	32.63	34.60	30.85
1954-1957*	31.30	29.07	32.42	28.87

*Four years

A reduction in the acreage of cultivated land on the Deep Fork watershed also has influenced the progressive rate of silting in this area. Cultivated land on the upper part of the Deep Fork watershed has been decreasing for many years. The change in cultivated acres in Lincoln and Logan counties has been as follows: 608 thousand acres in 1930; 408 thousand acres in 1940; and 361 thousand acres in 1950. This reduction in cultivated acres has greatly reduced the quantity of sediment carried into tributary streams by runoff water. However, many gullies continue to deepen after abandoned fields are covered with weeds and sub-climax grasses. Consequently, sediments carried into tributary streams by gully erosion along with stream-bank erosion of the Deep Fork drainage channel in some areas has continued to supply considerable quantities of coarse- and fine-textured alluvium which is deposited wherever flood water is retarded by a change in gradient, or by a vegetative barrier.

The total acreage of land severely damaged by deep deposits of recent alluvium in Creek and Lincoln Counties prior to 1938 was about 2800 acres; 2900 additional acres were covered with sediment in eastern Lincoln County from 1938 to 1943; 1200 acres from 1943 to 1948; 1600 acres from 1948 to 1953; and about 1000 acres from 1953 to 1958. The total area of deeply-silted land in this area is about 9600 acres. Excellent crops of corn and cotton formerly were produced on some of the land, and improved pecan groves were present on many farms before this part of the Deep Fork valley was covered with a deep deposit of silt and/or water. No agricultural income is being obtained from this land at the present time.

Changes in elevation between the low-water stage of the Deep Fork drainage ditch and the adjacent flood plain, caused by the rapid accumulation of alluvium, obtained at eight different points in 1943, 1948, 1953 and 1958 are presented in Table II. These results show that the stream channel at the bridge on Oklahoma Highway No. 18 south of Chandler, Oklahoma, and at the first and second mile east of this point has been filled at an average rate of about four inches per year during the past 15 years. Local silting in this area may be caused from a deepening of the Deep Fork channel near Warwick, Oklahoma. The height of the bridge north of Sparks above low water was less in 1958 than in 1953, although a measurement made about 300 feet west of this bridge indicated that the distance between ponded water in the stream channel and the elevation of the adjacent flood plain was slightly greater in 1958 than in 1953. Some

silting of the adjacent flood plain may have been responsible for this change. Measurements taken east of the railroad bridge northeast of Sparks, Oklahoma, (Station No. 5) indicated that some scouring of the stream channel had occurred. Flood water in late June, 1958 was probably responsible for the removal of sandy alluvium from the stream bed in this area.

Table II. Effect of recent silting on changes in elevation between the stream bed of the Deep Fork drainage ditch and the adjacent flood plain in the eastern part of Lincoln County, Okla. 1943-1958.

No.	Location			Year and depth of stream bed or low-water stage in feet below flood plain			
	Section	Twp. North	Range East	1943	1948	1953	1958
1	NW¼ 33	14	4	10.89	7.90	6.65	5.75
2	NW¼ 34	14	4	9.45	8.08	7.33	4.00
3	NW¼ 35	14	4	6.81	5.14	3.09	1.90
4	SE¼ 36	14	4	8.87	5.09	3.44	3.93
5	SW¼ 5	13	5	9.48	7.18	5.07	6.45
6	NE¼ 10	13	5	9.48	5.45	4.63	8.28*
7	NW¼ 5	13	6	6.80	7.80**	3.39†	1.30†
8	NW¼ 28	14	6	3.20	.22†	2.68†	2.70†

* Deep deposit of sand has raised adjacent flood plain at this point.
** 4.1 feet of alluvium over buried soil.
† Water in stream channel higher than old flood plain.

A deep deposit of sand has accumulated during the past five years on each side of the drainage ditch near station No. 6. (See Table II). These deposits have increased the distance between the height of the adjacent flood plain and the water in the stream at low-water stage. This condition is similar to the sedimentation pattern observed in previous years at other downstream locations. About 20 to 24 inches of silty clay has been deposited between the deeply-sanded area and the upland south and east of the bridge at station 6. Several feet of recent alluvium have accumulated at all points east of the NW¼ Sec. 10, T. 13 N., R. 5 E. The original timber, primarily oak, pecan, and elm, has been killed by the combined effect of deep silting and a rise in the water table in this area.

A slight lowering of the water level in a large lake occurring on each side of Oklahoma Highway No. 99 south of Stroud was observed during the past five years. This lowering may be due to a gradual deepening of the drainage channel at the east end of the silted area in Lincoln County.

Shallow braided channels were present in the Deep Fork valley for three miles east of the Lincoln-Creek county line from 1938 to 1943. Some retrenchment was observed in the eastern part of this area when a field survey was made in the fall of 1953. Channel depth at the abandoned bridge south of Milfay, Oklahoma, had increased to 13 feet in October, 1958. The newly-formed channel has extended westward about 1.75 miles from this abandoned bridge to the junction with Euchee Creek. Shallow drainage channels extending from lakes on the south side of Deep Fork valley in Creek County have lowered the water level in these lakes appreciably since 1953. A deeper channel must develop across sections 30 and 31 in the southwest corner of Creek County before much change can occur in the lake levels in eastern Lincoln County. However, if channel development continues to move upstream during the next 10 years at a rate similar to that which has occurred during the past 10 years, it is quit probable that all of the large lakes south and east of Stroud, Oklahoma, will be drained by 1968. Some assistance could be provided by burning log jams in drain-

age channels before the logs are covered with silt. Also, an aerial application of 2, 4, 5-T to kill willows and cottonwoods, where they retard the flow of flood water, and the removal of the dead wood where it collects in drifts, would hasten the development of a deeper channel across the deeply silted area.

The drainage ditch between sections 28 and 29, T. 14 N., R. 6 E. was blocked with driftwood and alluvium during the past five years. The level of the water in this area is several feet above the original flood plain. Consequently, the problem of developing a drainage channel that will lower the water table in the lakes on each side of the old drainage ditch and provide a more favorable environment for plant growth cannot be solved until a deeper channel can develop through the silt that has filled the valley for several miles downstream from this location. New stream channels could form across that part of the Deep Fork valley that is covered by shallow lakes if a rapid improvement in natural drainage could occur across some of the areas on which cottonwood and willows are growing at the present time. It is quite probable that a new channel in this part of the Deep Fork valley will be as crooked as the original channel, because stream flow has been diverted from the drainage ditch in many places by log jams and deep deposits of silt.

If the Deep Fork channel could be lowered to the original level by natural erosion or by mechanical methods, flood hazards would be greatly reduced and the agricultural value of the silted area would be higher than its value prior to the completion of the drainage ditch in 1923.

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