Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 12 *Keeping up with Research*

Article 85

1975

Note: Revision with color art was produced for author's use only in 2010: Riparian Forests Protect Streambanks

Kansas Agricultural Experiment Station

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Keywords
Keeping up with research; 21 (Oct. 1975); Kansas Agricultural Experiment Station contribution; no. 566;

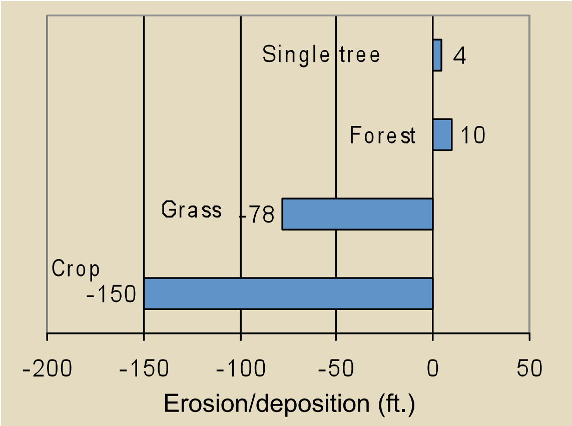

Figure 2. **Lateral movement of streambank by land-cover type.**

Land-cover vegetation significantly (P<0.01) affected the amount of lateral streambank erosion (Figure 2). Both forest and single tree-row vegetation types collected soil, with mean depositions of 10 and 4 ft, respectively, which were not significantly different. Grassland lost an average of 78 ft, and cropland lost an average of 150 ft. Surface acreage of the lost land was evaluated for each mile of stream erosion: 9.4 acres for grassland and 18.2 acres for cultivated land. The latter is equivalent to about a quarter section of land for every 10 miles of stream distance in this study.

These results show that woody vegetation is highly effective for protecting streambanks. Standing trees slow water movement, thus reducing the energy available for erosion and allowing deposition of suspended materials. Greater rooting depth, larger and stronger roots, and perhaps greater rooting density also stabilize the soil mantle.

Figure 3. **Natural woody vegetation should be left to protect streambanks.**

Conclusions

Trees are greatly beneficial in protecting streambanks against erosion during large floods. Tree cover reduced the extent of streambank erosion caused by the extreme flood of 1993 on the Kansas River. Forested areas on both sides of the river sustained less erosion than reaches that had no woody vegetation cover. Natural stands of timber should be left standing to protect the riparian ecosystem, afford greater bank stability and water quality, and reduce downstream sedimentation (Figure 3). Land next to the streambank should not be cultivated because of the potential for large acreage loss during high-water events, which occur frequently in central Kansas.

About the Author

Wayne A. Geyer, professor of forest science, Department of Horticulture, Forestry, and Recreation Resources, Kansas State University.

Acknowledgements

Support for the evaluation of trees and streambank erosion provided by the USDA Forest Service National Agroforestry Center is appreciated.

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SRL122 (Rev.) April 2010

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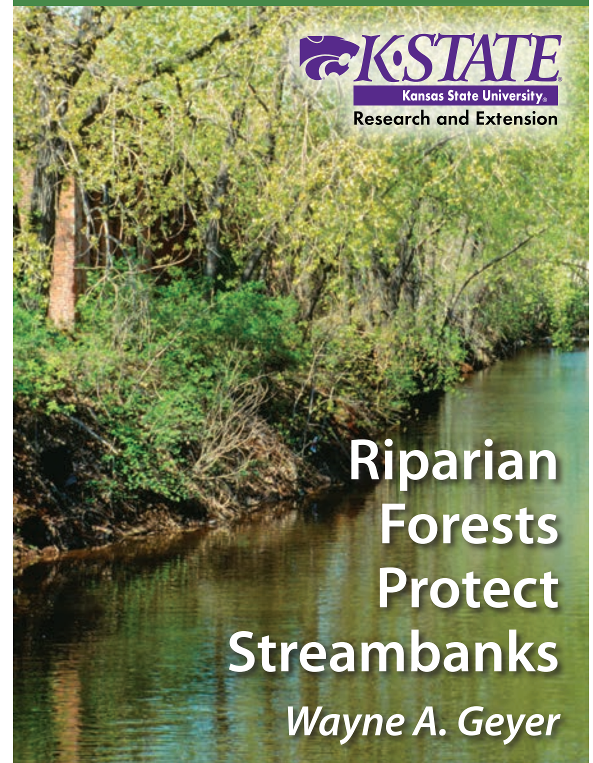

Riparian Forests Protect Streambanks

Wayne A. Geyer

Introduction

Streambank erosion is a natural adjustment process of rivers, but lateral migration rates of the stream channel can be accelerated, especially by variables that affect bank material and flow stress in the near-bank region. Lowland sites are often the best areas for growing cultivated crops as well as forest products. Cropping right up to the bank is tempting because of the high yields, but one good-sized flood can cause untold damage and great loss of land for future production. Retaining the natural woodlands along our streams and rivers will protect the banks.

Woody vegetation is effective for stabilizing streambanks and reducing erosion under normal streamflow conditions. Vegetation reduces streambank erosion by

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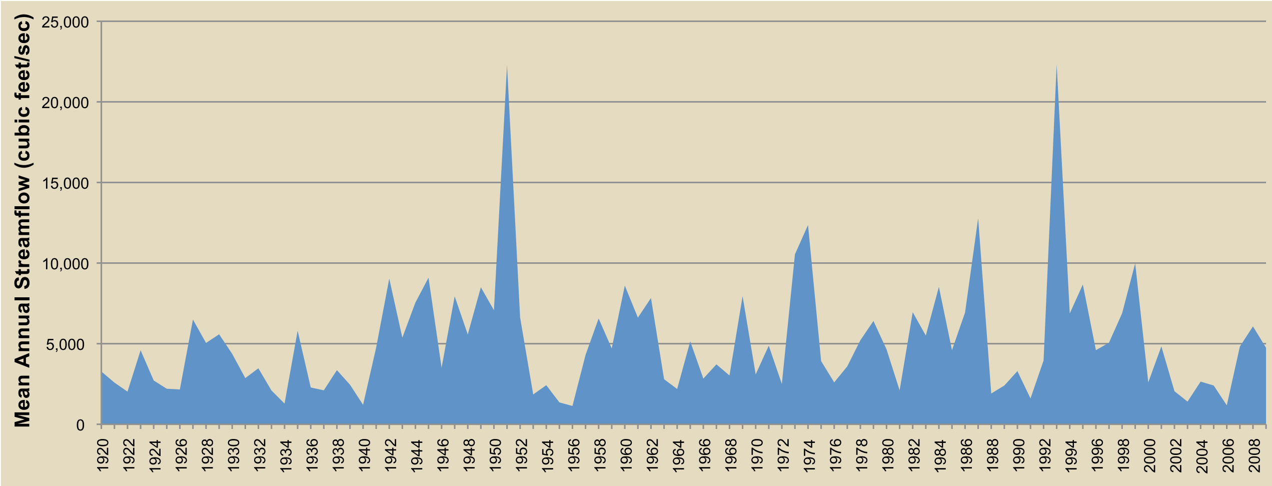

Figure 1. **Historical mean discharge of the Kansas River at the beginning point of the study area (Wamego, Kan.).**

slowing streamflow velocity, trapping sediments in its stems and foliage, and binding soil.

Streambank channel erosion varies with channel position. Extensive erosion typically occurs at the outside bend, where flow velocities are greatest, whereas soil particles deposit and form sandbars at the inside bends, where velocities are slowest.

Variation of stream discharge appears to occur in about 15- to 20-year cycles. The flood of 1993 (500 year) was of historic proportions, but a similar flow occurred in the early 1950s. Streamflow in central Kansas in 1950 and 1993 was 4.5 times the historical yearly averages (Figure 1). Because of this variation, streambank losses usually are not recognized until a major high-water event happens.

Erodibility depends on bank height, the ratio of root depth to bank height, bank angle, and surface protection. High, steep banks, steep undercut banks, low root density, highly stratified soil, and fine soil particle size all increase erosion potential.

Studies conducted in the Midwestern United States have shown that erosion from wooded areas, grasses, corn, and fallow land is 0.00, 0.04, 73.2, and 69 tons/acre, respectively.

This study was undertaken to evaluate the influence of natural woodland vegetation on lateral streambank erosion/deposition following the 1993 flood.

Procedures

Study Area

The study area was in the Kansas River Basin, which covers about 60,000 square miles in three states. The specific zone of study was a 40-mile portion near Manhattan, Kan. The woody vegetation along the river consists of many tree species including cottonwood (*Populus deltoides*), silver maple (*Acer saccharinum*), willow species (*Salix* spp.), hackberry (*Celtis occidentalis*), sycamore (*Platanus occidentalis*), and elm species (*Ulmus* spp.).

Tools of Investigation

Local offices of the Consolidated Farm Service Agency provided slide images of the study area taken in December 1992 and December 1993. These aerial images were used to compare easily identified features, such as riparian vegetation and streambank edge, of pre- and post-flood streambanks.

Data Collection Process

Photocopies of the slides were transferred with a CalCompl digitizing tablet into a LandCADDI R12 computer-aided drawing (CAD) program file. The photocopies were calibrated to previously digitized U.S. Geological Survey 7.5-min topographical quadrangle maps to enable accurate scaling and analysis of the images. Only features useful in calibrating slide images, such as roads, railroad tracks, and mile section lines, were digitized from the quadrangle maps.

Once the base maps were digitized, streambank edges from the 1992 and 1993 slide images of the Kansas River were digitized. Notes regarding land-cover condition were made within the drawing as needed.

Then a river centerline was interpolated within the CAD drawing by using the 1992 streambanks as a guide. The centerline served as a reference for river position and demarcation and land-cover classification.

Data collection points were established at regular 500-ft intervals along the centerline in the study area. At these points, land cover was classified by using the 1992 aerial photographs as references. Erosion and deposition amounts were estimated by measuring the perpendicular distance from the 1992 streambank to the 1993 streambank at data collection points.

Land-cover vegetative types in the 100-ft zone next to the 1992 streambank were categorized as forest land, cropland, grassland, or single tree-row. A forested streambank is one on which the dominant land-cover type (>51%) is woody vegetation. A cropland or grassland streambank is one on which the dominant land-cover type is agricultural crops or grass, respectively. A single tree-row streambank has a single row of trees adjacent to a non-forest land-cover type.

Vegetation data were collected for both the left- and right-side streambanks at every data collection point and inserted into the CAD program. Data from both sides of the river were pooled.

Results and Discussion

Data were collected from 204 streambank points (103 right side and 101 left side). These data points were classified as follows: 96 points as forest land, 37 as cropland, 47 as grassland, and 24 as single tree-row. Thus, 59% of the banks were tree lined.

About 62% of the banks had sandy soils, and 38% had loamy soils. The streams generally were of two types, meandering (63%) and relatively shallow and braided (37%). Many of the streambanks were entrenched.