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Long-term Sediment Yield and the Trap Efficiency of Flood Control Reservoirs in the Texas Blackland Prairie

The Texas Blackland Prairie is a 49,700 km^2, north-south trending belt of fertile rolling farmland that stretches from the Red River to San Antonio. The Blacklands are home to both 7 million people and 5,000 km^2 of active crop and pasture lands. To support these activities, the natural rivers and streams of the region have been modified with the addition of 20 large water supply reservoirs and a system of over 350 small upland flood control reservoirs. The useful lifespan of these reservoirs and the quality of the water stored within them is largely limited by the sediment load of contributing streams. In this study we combine the results of 8 surveys of water supply reservoirs with 10 surveys of flood control reservoirs using acoustic the sub-bottom profiling method to construct a new sedimentation curve for reservoirs of the Texas Blackland Prairie. We seek to explain the amount of sediment found in each of the surveyed reservoirs in terms of the sediment yield by sheet and rill, and gully and stream erosion per unit area of the supplying watershed. The generated sediment is discounted by delivery ratios for the two sediment sources, plus the number, distribution, area of watershed, and trap efficiency of all upstream reservoirs. By comparing observed sedimentation rates with conventional sediment yield and delivery estimates, we conclude that the long-term trap efficiency of the flood control reservoirs in the Texas Blackland Prairie has been approximately 40 percent. The overall affect of upstream sediment retention has been to reduce sedimentation in large water supply reservoirs to rates comparable to those expected for watersheds composed completely of native forestlands. These results underscore the benefits of preserving the sediment retention function of existing flood control reservoirs in terms of extending the useful life of downstream water supply reservoirs.

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