Predicting streambank erosion rates in the U.S. Gulf Coastal Plain
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Introduction
Streambank erosion is a major source of alluvial sediment [1] and nonpoint-source pollution [2], but it is notably difficult to model [3]. Practitioners often rely on predictive models that are empirically calibrated to a given hydrography region. An example of such a model is the Banks Assessment of Nonpoint-source Consequences of Sediment (BANCS) method [4], but it has not yet been developed for the U.S. Gulf Coastal Plain. BANCS has given inaccurate predictions when applied in some regions [5]. A common theme among studies showing poor BANCS performance is the presence of woody vegetation [6], which is difficult to quantify in an empirical, field-based model. Both above- and below-ground biomass mediate bank erosion rates [7].

BANCS method
Banks are ranked and grouped according to a bank erodibility hazard index (BEHI), and a separate near-bank shear stress index (NBS) is regressed onto measured erosion rates. BANCS is semi-quantitative, and relies on visual estimations of root density, root depth, and bank protection. In addition, BEHI independent variables are traditionally indexed using rather arbitrary graphs and index tables.

Objectives
• Assess new field techniques designed to replace visual estimations by quantifying the control of bank vegetation on erosion rates in the U.S. Gulf Coastal Plain
• Develop a robust statistical procedure for predicting bank erosion rates

Methods
• Measure bank erosion at 75 sites over 1 year (vertical profile method)
• Bank biomass density survey
• Root density survey based on point-intercept method
• Channel curvature index
• Nonlinear model selection by Akaike’s Information Criterion

Results
The chosen model predicts streambank erosion rates with 8 free parameters. Bank angle, soil bulk density, soil sand content, and upstream drainage area (a proxy for discharge) are also included in addition to the variables described at left.

Conclusions
Building on previous analyses of streambank erosion processes, we have developed and tested two field techniques that quantify the effects of vegetation on annual streambank erosion rates. Based on the current conceptual model of erosional processes, several independent variables were chosen for statistical analysis. The most predictive variables emerged in a nonlinear model that accurately predicts annual erosion rates. Our model may be useful for practitioners seeking a more quantitative approach, and could inform modifications to BANCS. The tiered nonlinear model selection approach employed here may be of interest to researchers of any discipline. Future work should focus on testing the applicability of the erosional processes implied by these variables, as well as identifying other potential controls on streambank erosion.

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