A review of vegetated buffer efficacy

February 16 2010

Agricultural nonpoint source pollution has been listed as one of the leading sources of pollution in rivers and water bodies throughout the world. Environmental regulators and scientists are making concerted efforts to reduce these pollutions using mitigation tools called best management practices (BMPs). As promising and effective BMPs, vegetated buffers are gradually gaining in popularity. However, lack of quantification on their mitigation efficacies limits their implementation in agricultural fields to reduce nonpoint source pollutions.

Scientists at the University of California, Davis, reviewed more than 300 papers, analyzed the data from these studies, and developed statistical models describing the mitigation efficacies of vegetated buffers. Specifically, they established the relationships between buffer pollutant removal efficacy and buffer width, buffer slope, soil, and vegetation types. Results from the study were published in the January-February 2010 issue of *Journal of Environmental Quality*. Part of the research was presented at the second World Agroforesty Congress in Kenya, August 2009; part of the results will also be presented in San Francisco, CA, at the American Chemical Society 239th National Meeting in March 2010.

Data gathered for the extensive literature review were compiled into a digital database. Theoretical models for removal efficacy were derived and tested against data from the surveyed literature using statistical analyses methods.

The relationship between buffer width and pollutant removal was successfully captured by a model, and buffer slope was shown to be

linearly associated with sediment removal efficacy for slopes less than or equal to 10% or negatively for slopes greater than 10%. The effects of vegetation were demonstrated by the results that buffers with trees have higher nitrogen and phosphorus removal efficacy than buffers with grasses or mixtures of grasses and trees. However, soil drainage type did not show a significant effect on pollutant removal. Based on the scientists' analysis, a 30-m buffer under favorable slope conditions (about 10%) removes more than 85% of all the studied pollutants.

The study reveals the quantitative relationships between mitigation efficacies of vegetated buffers and their width, vegetation type, and slope. The results from this review and data analysis were confirmed by a group of researchers from the USDA in Oklahoma and University of Kenya in Naribo through field experiments.

As Minghua Zhang, one of the authors of the study, notes, "This information could serve as baseline data for setting guidelines for buffer implementation and installation. In addition, estimated parameters could facilitate further investigations on buffer efficacy beyond field scale. The results of this study will assist in future modeling efforts to study the mitigation efficacy of vegetated buffers for reducing pollutants in agricultural runoff at watershed scale."

More information: View the abstract at jeq.scijournals.org/cgi/content/abstract/39/1/76 .

Provided by American Society of Agronomy

Citation: A review of vegetated buffer efficacy (2010, February 16) retrieved 27 April 2024 from https://phys.org/news/2010-02-vegetated-buffer-efficacy.html

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