A Review of Vegetated Buffers and a Meta-analysis of Their Mitigation Efficacy in Reducing Nonpoint Source Pollution

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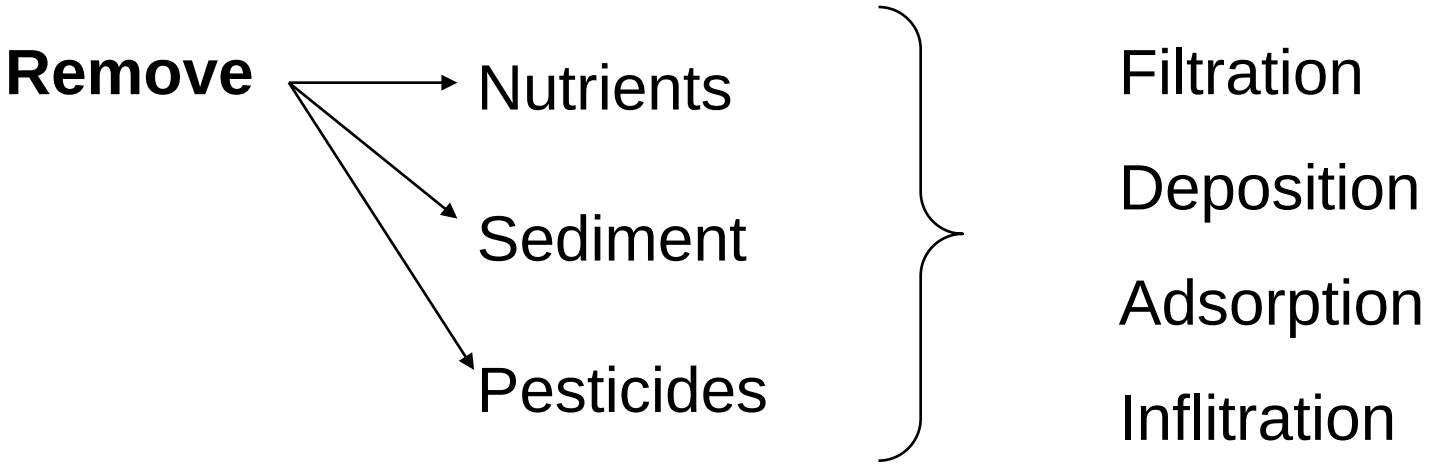
Vegetated Buffer Strips

Management practise widely used for reducing nonpoint-source pollution.



Mitigation Efficacy

- Physical properties of the Buffer Strip
- Pollutant properties
- Buffer Placement

Design and implementation of Buffer Strips

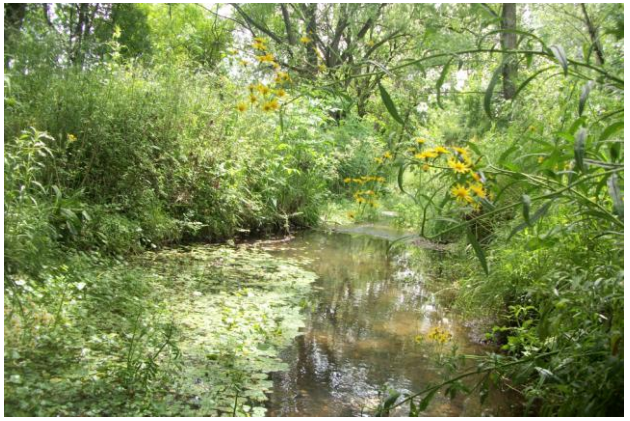
Theoretical model

Buffers Pollutant Removal Efficacy ⟷ **Key design factors**

Summary of collected data

Variables	Sediment	Nitrogen	Phosphorus	Pesticides
Number of study sites	27	10	10	4
Number of buffers	56	22	19	8
Data on buffer width	81	61	52	49
Data on buffer slope	79	12	8	0
Data on vegetation	81	61	52	49
Data on soil drainage type	81	61	52	12

Objectives



- Aggregate data from studies on the **mitigation efficacies** of vegetated buffers for removing sediment, N, P and pesticides.
- Quantify the relationships between pollutant **removal efficacy** and buffer **design factors** through theoretical models and statistical analysis of the aggregated data.

1. What is the main findings of BS functioning in your paper?

Width

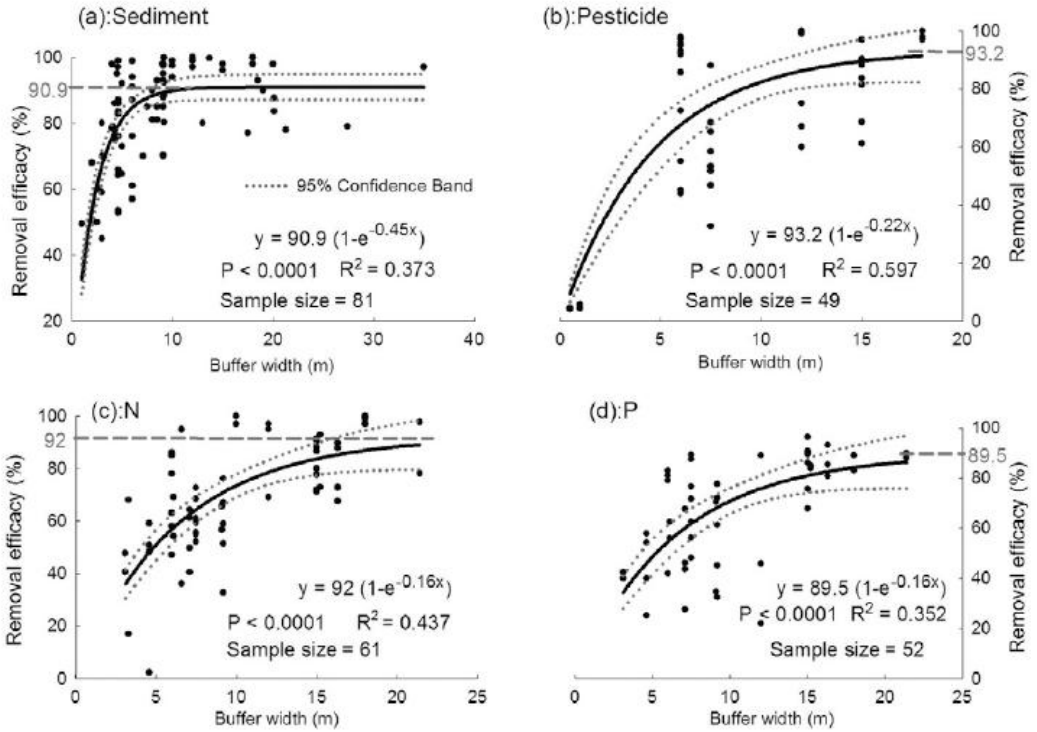


Fig. 3. Pollutant removal efficacy vs. buffer width for each pollutant. Black dots are data and lines are model predictions. Dotted red lines indicate 95% confidence band. The limiting value of *K* is shown in pink with a dotted line. Details of the model are given in each figure for (a) sediment, (b) pesticides, (c) N, and (d) P.

In all cases, the removal efficacy increases quickly with increase in buffer width and the rate of increase becomes smaller as the buffer gets wider until the efficacy approaches a maximum value (the removal capacity).

Pesticide removal efficacy : the highest 93,2%

Slope

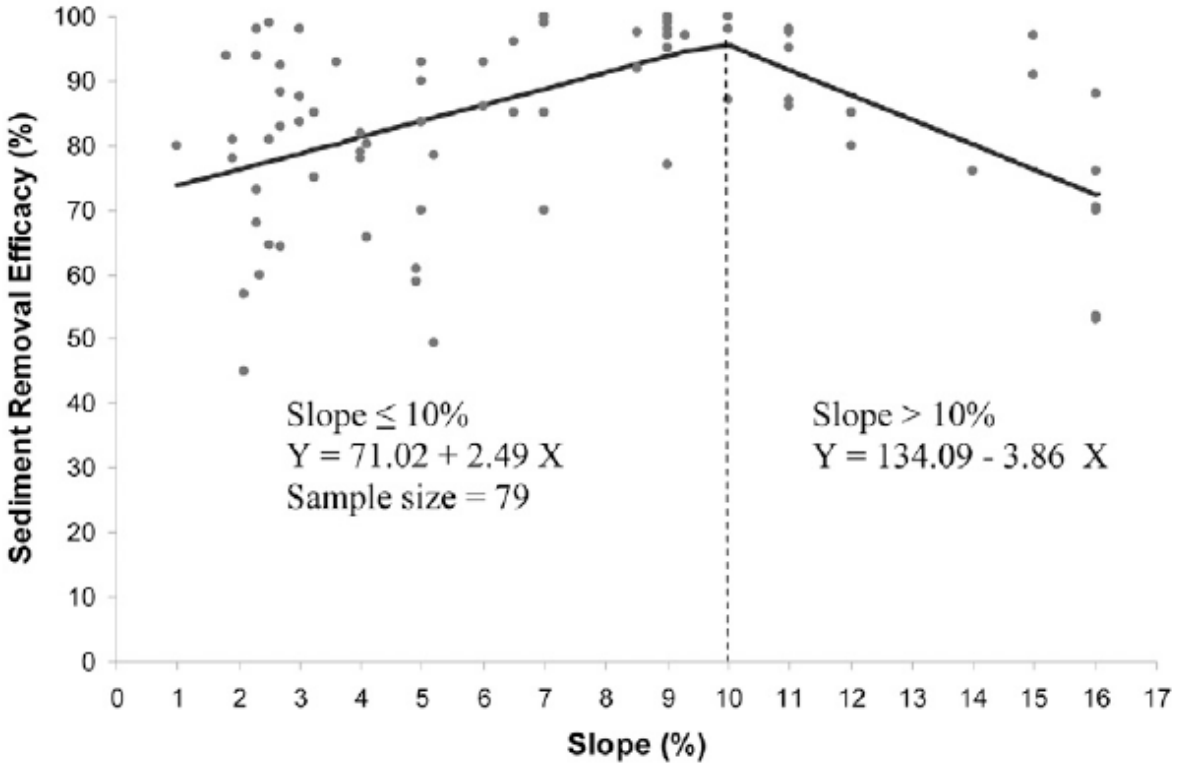


Fig. 3. Correlation between sediment removal efficacy and buffer slope

Sediment removal efficacy increases as slopes increase from 0 to 10%. Buffers steeper than 10% become less effective with increasing slope.

Vegetation type and Soil drainage type

- Buffers composed of only grasses or trees remove more sediment than that with mixed grasses and trees.
- For N and P removal, vegetation composed of trees has a higher removal efficacy than vegetation composed of grasses or mixed grasses and trees
- The impact of soil drainage type on pollutant removal efficacy was not statistically significant

2. Is there any doubts about the functioning of BS's as an ecosystem services given in your paper?

✓**This article is a review of the efficacy of the Buffer Strips in reducing nonpoint source pollution**

3. Can BS's assist in reducing N and P loadings to surface waters (rivers, lakes and estuaries) – and how efficient?

• Vegetated Buffer are widely used in agricultural production for reducing agricultural nonpoint source pollution.

•Designed to use vegetation to remove sediments, nutrients and pesticides from surface water.

•Buffer width, slope, and vegetation type are important factors for designing an effective buffer.

4. Is there any requirements about how to install and manage the BS's?

Predicted pollutant removal efficacy

Table 4. Predicted pollutant removal efficacy.

		Predicted removal efficacy, %			
	Buffer width =	5 m	10 m	20 m	30 m
Sediment	(a) Slope = 5%; mixed grass and trees	67	76	78	78
	(b) Slope = 5%; grass/trees only	82	91	93	93
	(c) Slope = 10%; mixed grass and trees	77	86	88	88
	(d) Slope = 10%; grass/trees only	92	100†	100	100
	(e) Slope = 15%; mixed grass and trees	58	67	68	68
	(f) Slope = 15%; grass/trees only	73	81	83	83
Nitrogen	(a) Mixed grass and trees/grass only	49	71	91	98
	(b) Trees only	63	85	100	100
Phosphorus	(a) Mixed grass and trees/grass only	51	69	97	100
	(b) Trees only	80	98	100	100
Pesticide		62	83	92	93

† If predicted values exceed 100, the value of 100 was assigned instead.

These models can provide valuable information for simulating vegetated buffer efficacy at the watershed scale, which is increasingly becoming a useful scientific tool for making effective policy and regulation decisions to reduce nonpoint-source pollution.

5. Other ecosystems services besides removal of N and P?

- Reduction of multipollutants simultaneosly: Sediments, Pesticides.
- Habitat heterogeneity
- Increase in Biodiversity
- Flood control


Thank you!
Gracias!
Dank!
Tak!