

# Phosphorus Removal in Agricultural Riparian Buffers: A Meta-Analysis

Hope Zabronsky, March 2016



Riparian buffer - [www.upstreammatters.com](http://www.upstreammatters.com)



Hope Zabronsky- Photo Credit Nicolas Gomez



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# Introduction

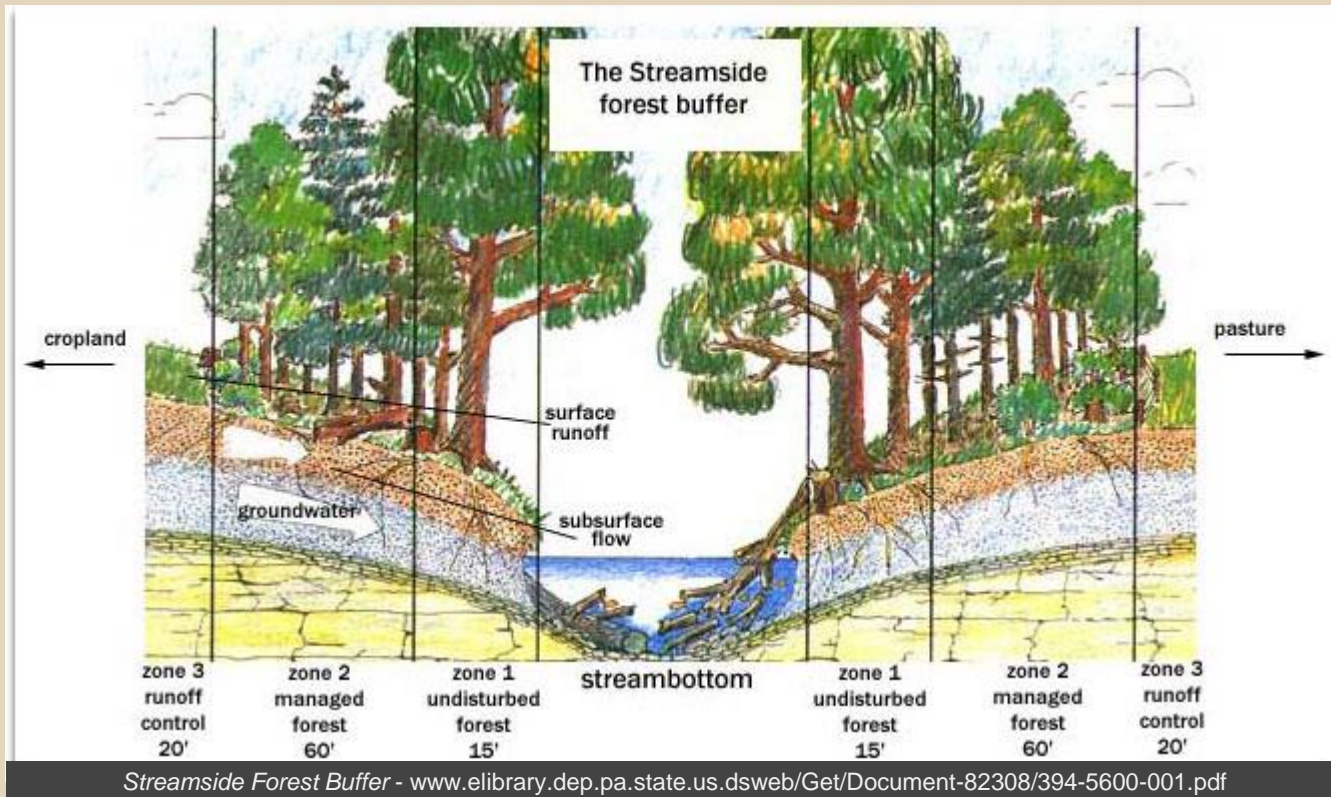


*Phosphorus Loading* - [www.middlebury.edu/media/view/276855](http://www.middlebury.edu/media/view/276855)



*Lake Champlain: Issues and Threats* - [www.mychamplin.net/threats-explained](http://www.mychamplin.net/threats-explained)

# Riparian Buffers



# Why Meta-Analysis?

- ❖ To synthesize data from independent studies
- ❖ To identify factors that maximize P reduction
- ❖ To determine the most effect buffer designs



# Meta-Analysis Procedures

Establish a research question



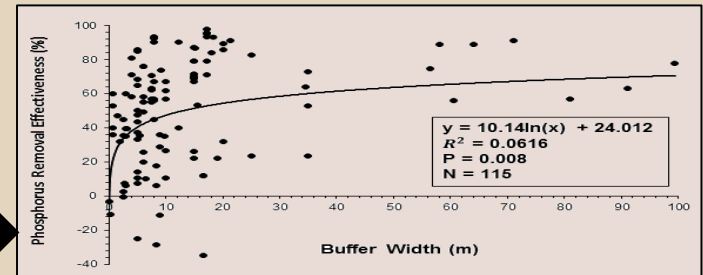
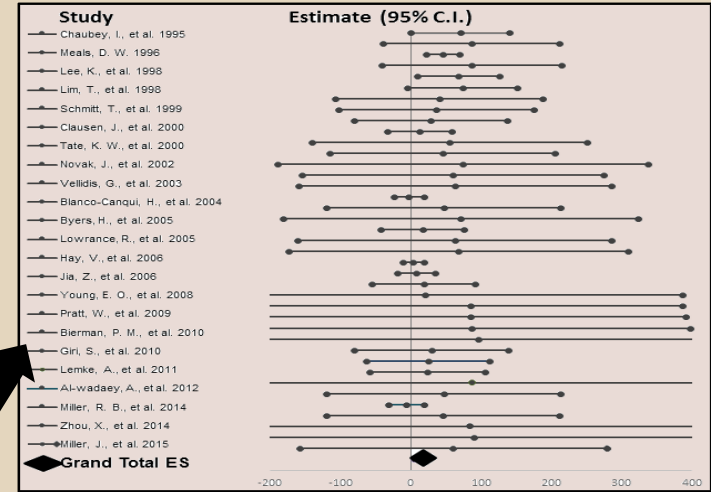
Conduct a literature review



Record study characteristics



Calculate P removal effectiveness

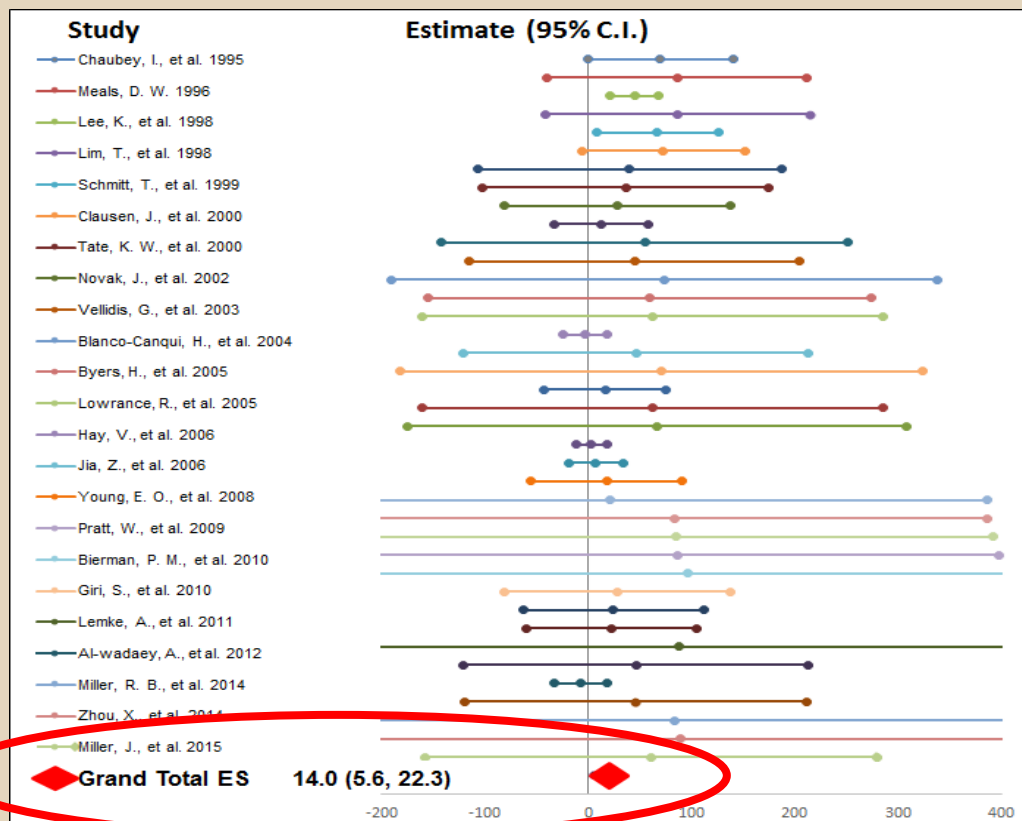


# Phosphorus Removal Effectiveness Varied Between and Within Studies

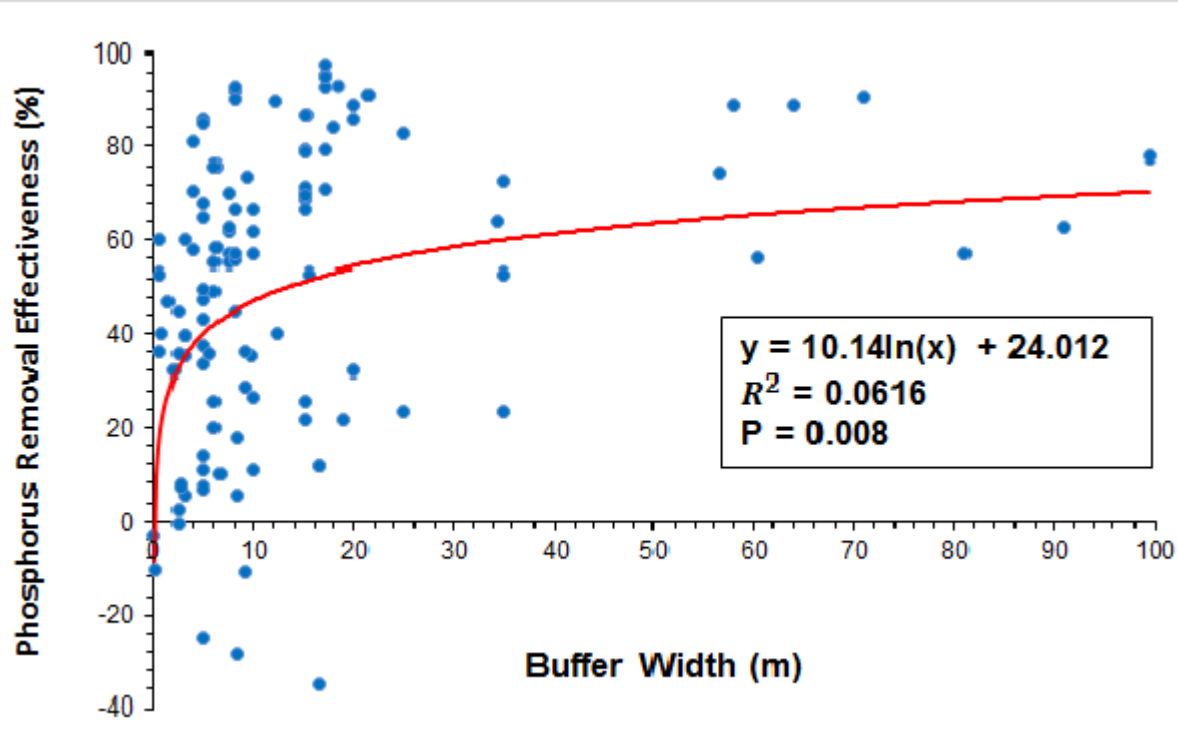
**Table 1.** Summary of riparian buffer effectiveness at removing P by vegetative cover, hydrologic flow path, buffer width, and soil type (“\_” = data not provided by authors).

Study	Vegetative Cover	Flow Path	Buffer Width	P form	P removal effectiveness (%)	Major Soil Type
Chaubey, I., et al. 1995	Grass	Surface	3.1	TP	39.6	Silt
	Grass	Surface	6.1	TP	58.4	Silt
	Grass	Surface	9.2	TP	74	Silt
	Grass	Surface	15.2	TP	86.8	Silt
	Grass	Surface	21.4	TP	91.2	Silt
Meals, D. W. 1996	Grass	Surface	_	TP	86	Clay
Lee, K., et al. 1998	Grass	Surface	3	TP	39.5	Loam
	Grass	Surface	3	TP	35.2	Loam
	Grass	Surface	6	TP	55.2	Loam
	Grass	Surface	6	TP	49.4	Loam
Lim, T., et al. 1998	Grass	Surface	6.1	TP	76.1	Silt
	Grass	Surface	12.2	TP	90.1	Silt
	Grass	Surface	18.3	TP	93.6	Silt

# Weighted Effect Size Means for all Studies



# Regression Plot Buffer Effectiveness



Tsai, Y., H. Zabronsky, B. Beckage, A. Zia and C. Koliba. 2016. A Review of Phosphorus Retention in Riparian Buffers: An Application of Random-Effects Meta- and Multiple Regression Analyses. J. Environ. Qual. 1-29.

**R-Squared = 0.569**



# Conclusion

- ❖ Wider buffers tended to attenuate more P
- ❖ Vegetative cover, soil type, and slope likely influenced P removal effectiveness
- ❖ Future studies should integrate multiple factors

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# Questions?



*Lake Champlain Boat Launch - [www.mychamplain.net/forum/lake-champlain-boat-launch-stewards](http://www.mychamplain.net/forum/lake-champlain-boat-launch-stewards)*

# Literature Cited

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