





Does Lake and Stream Connectivity Control Phosphorus Retention in Lakes?

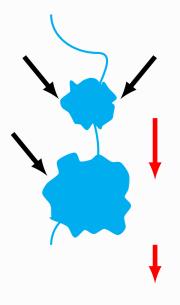
Joseph Stachelek and Patricia Soranno

Michigan State University

Assoc. Limnology and Oceanography, 2018 June

http://doi.org/ckpf

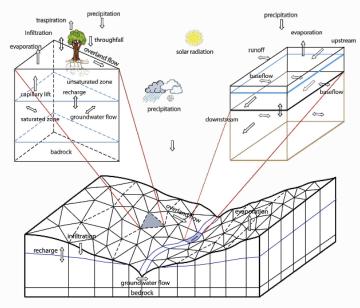
LAKE PHOSPHORUS (P) RETENTION



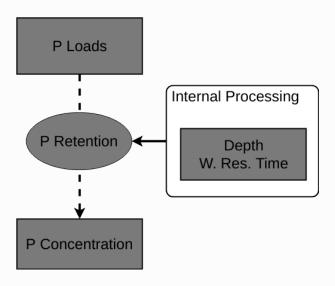
P retention directly controls downstream transport [Alexander et al., 2002]

P retention indirectly controls sediment P accumulation [Søndergaard et al., 2013]

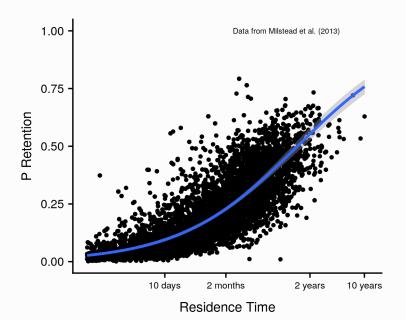
PREDICTING FLUX IS COMPLEX AND LABOR INTENSIVE



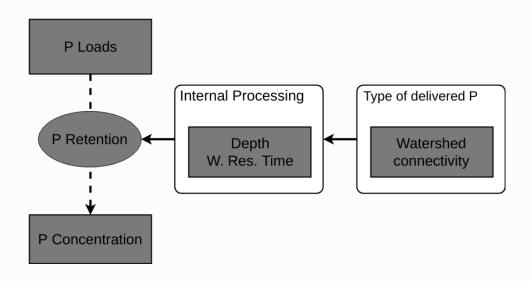
P RETENTION CONCEPTUAL MODEL



P RETENTION VERSUS WATER RESIDENCE TIME



EXTENDING P RETENTION MODELS



MULTIPLE WAYS TO DEFINE CONNECTIVITY

Low Connectivity

High Connectivity





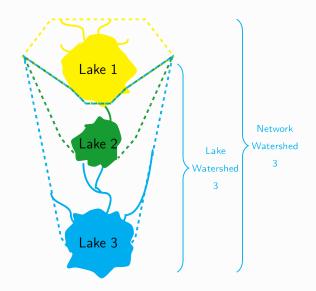
Closest Lake Distance: Network distance to the closest upstream lake.



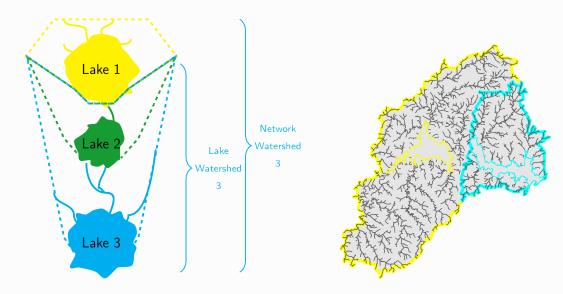


Average Link Length: Sum of the total length of stream reaches between junctions divided by the total number of reaches.

WATERSHED CONNECTIONS



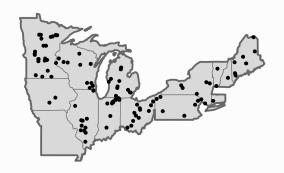
*WATERSHED CONNECTIONS



1. Does connectivity of lakes and their watersheds influence lake phosphorus retention?

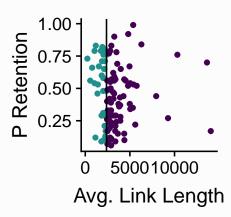
2. What is the relative importance of different connectivity metrics in determining lake P retention and what spatial extents are most important for connectivity and P retention?

METHODS - CONNECTIVITY PARTITIONS

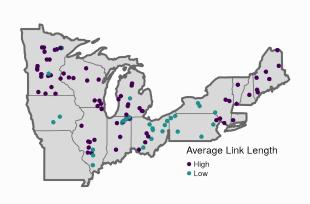


NES Lakes (n = 129)

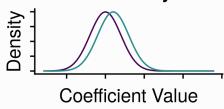
[Stachelek et al., 2017, USEPA, 1978]



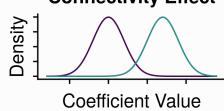
METHODS - P RETENTION MODELLING



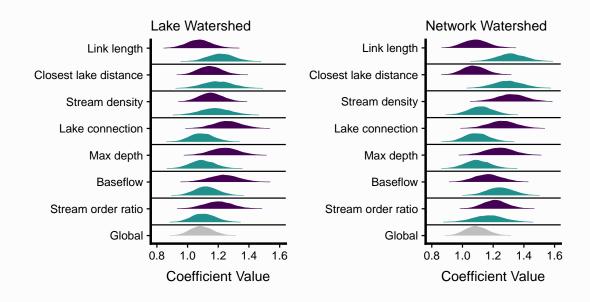
No Connectivity Effect



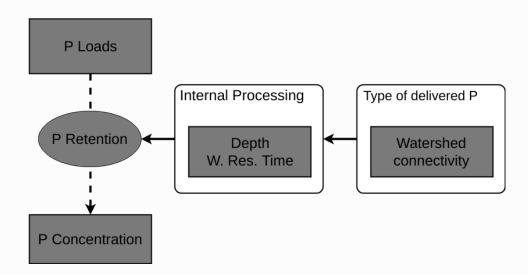
Connectivity Effect



P RETENTION (PROCESSING) COEFFICIENT DISTRIBUTIONS



CONCLUSIONS

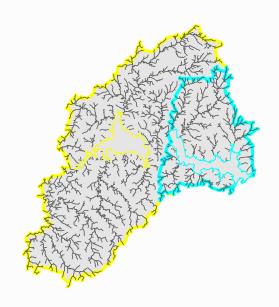


CONCLUSIONS

 Connectivity metrics at the network scale have a greater effect on P retention than metrics at finer scales.

 Use caution when treating lake watersheds as an analysis unit

 Watershed to lake area ratio likely reflects connectivity in addition to residence time







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