Does Lake and Stream Connectivity Control Phosphorus Retention in Lakes?

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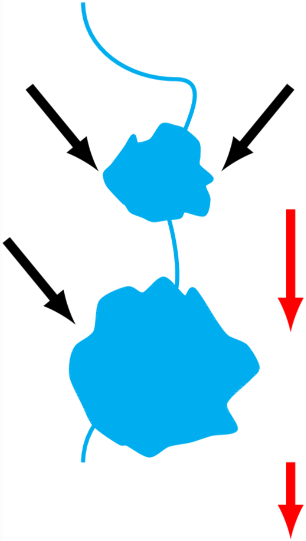
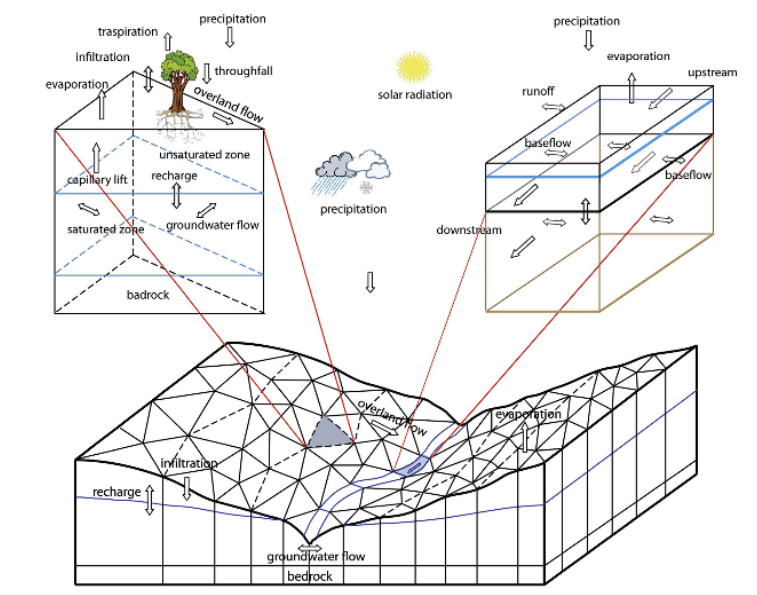
LAKE PHOSPHORUS (P) RETENTION



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

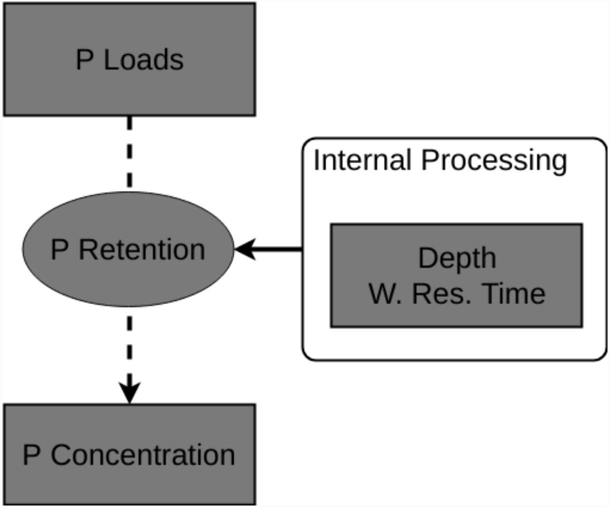
P retention indirectly controls sediment P accumulation [Søndergaard et al., 2013]

PREDICTING FLUX IS COMPLEX AND LABOR INTENSIVE

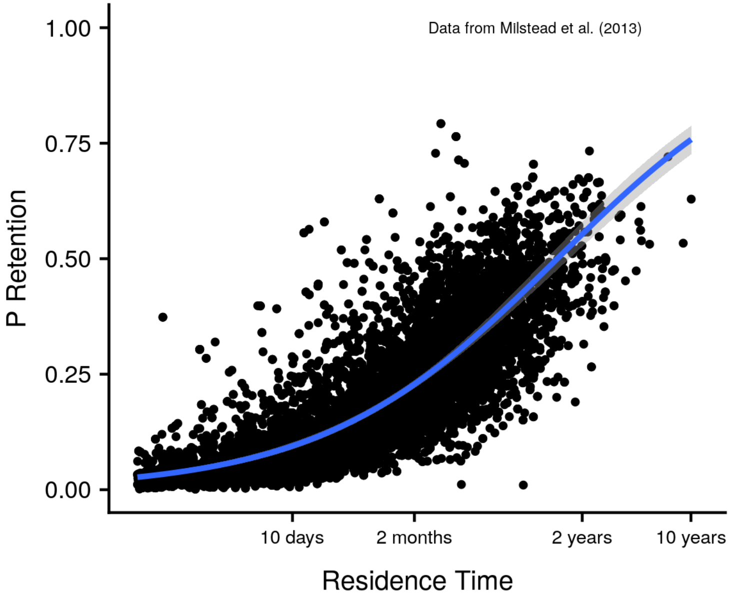


[Bhatt et al., 2014]

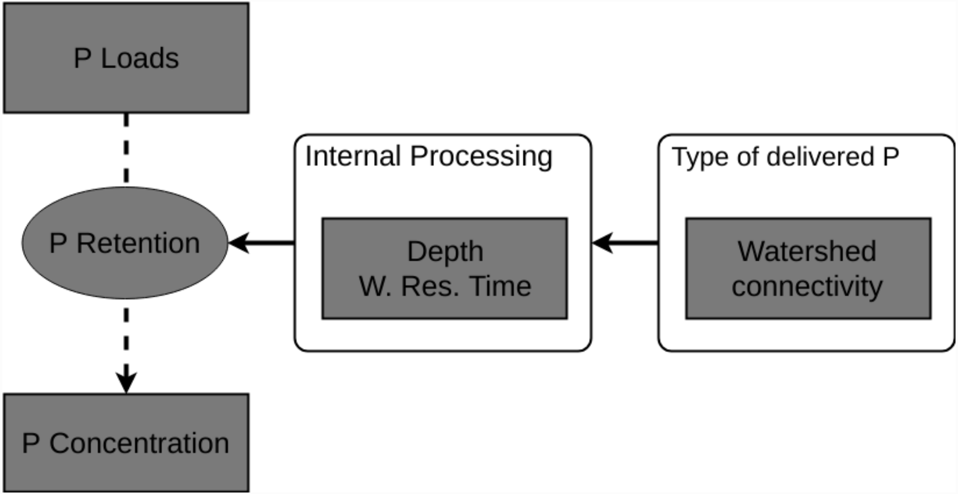
P RETENTION CONCEPTUAL MODEL



P RETENTION VERSUS WATER RESIDENCE TIME



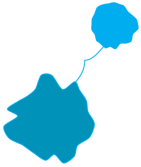
EXTENDING P RETENTION MODELS

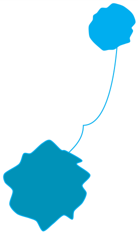


MULTIPLE WAYS TO DEFINE CONNECTIVITY

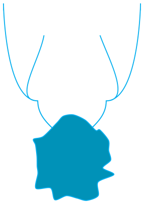
Low Connectivity | High Connectivity

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

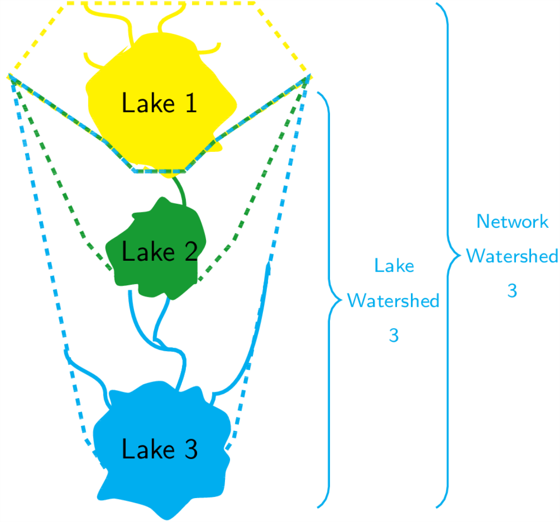




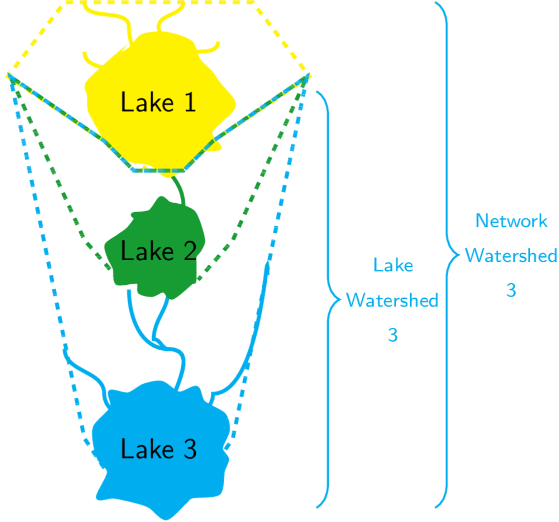
Average Link Length: Sum of the total length of stream reaches between junctions divided by the total number of reaches.

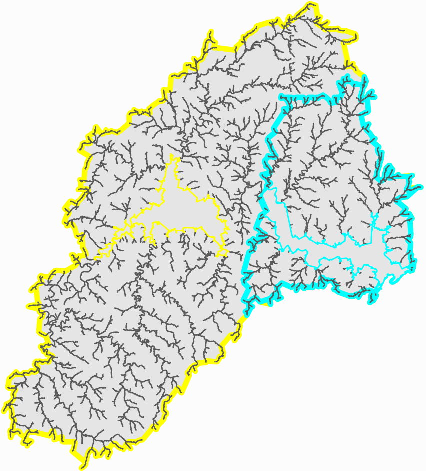


WATERSHED CONNECTIONS



WATERSHED CONNECTIONS

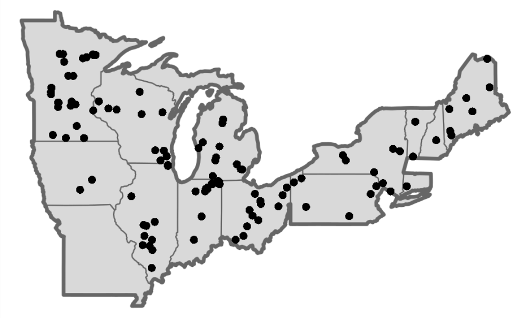




1. Does connectivity of lakes and their watersheds influence lake phosphorus retention?

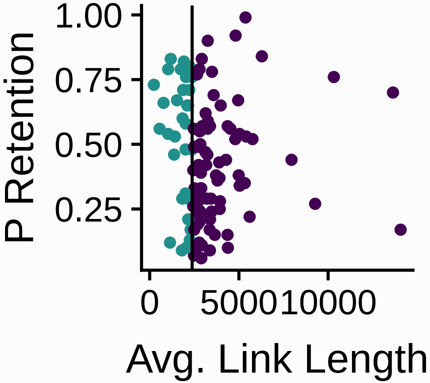
2. What is the relative importance of different connectivity metrics in determining lake P retention and what spatial extents are most important for connectivity and P retention?

METHODS - CONNECTIVITY PARTITIONS

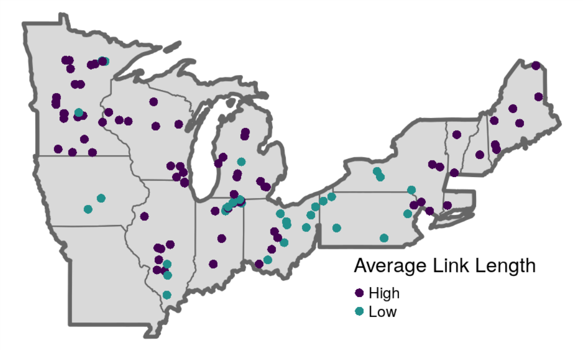


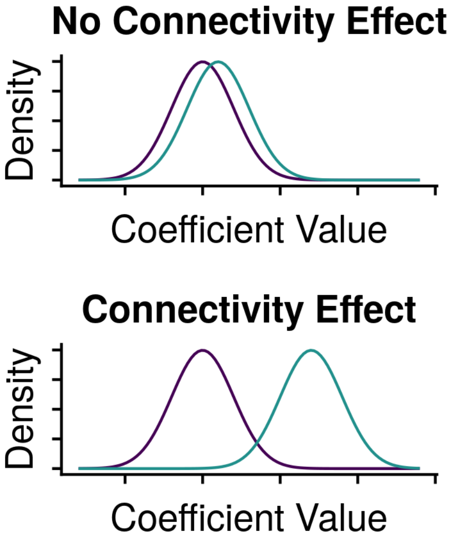
NES Lakes (n = 129)

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

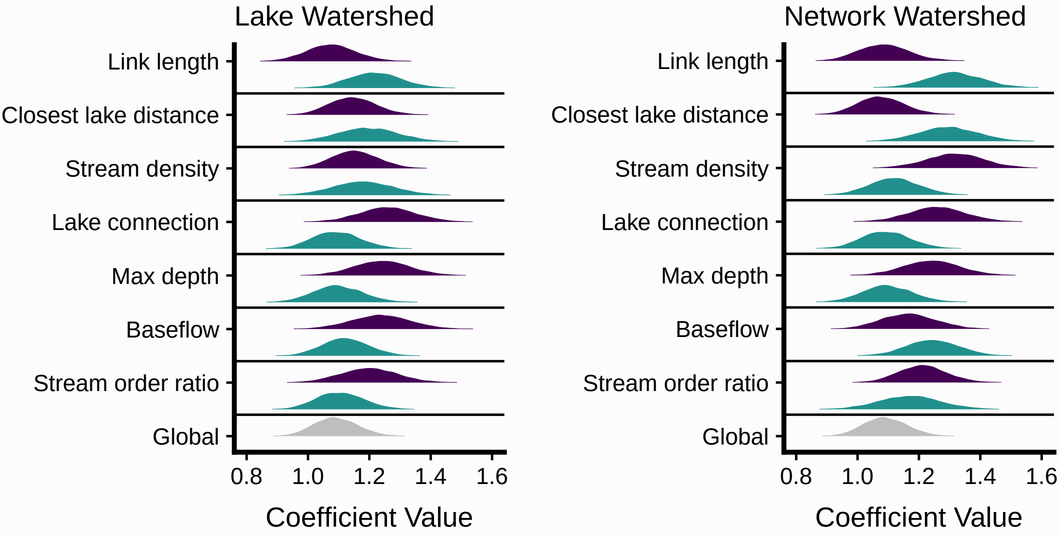


METHODS - P RETENTION MODELLING

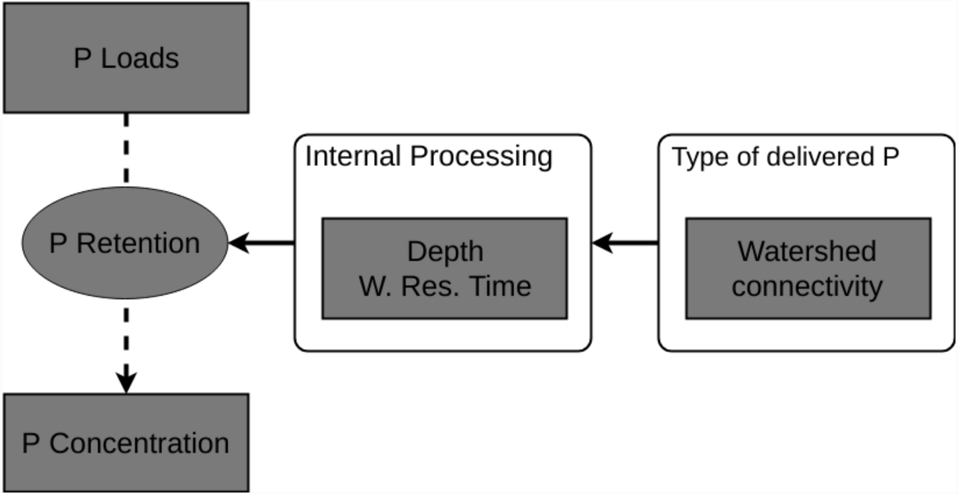




P RETENTION (PROCESSING) COEFFICIENT DISTRIBUTIONS

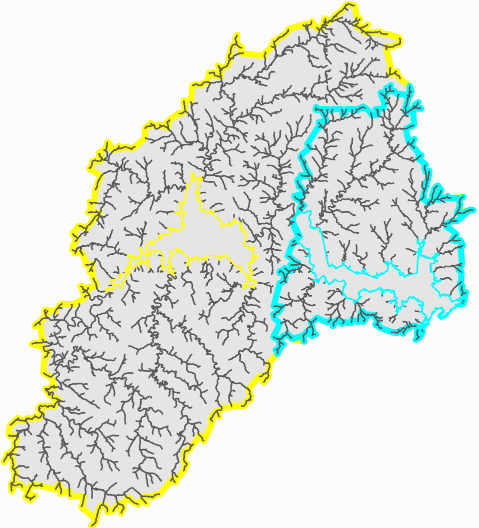


CONCLUSIONS



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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