Does Lake and Stream Connectivity Control Phosphorus Retention in Lakes?

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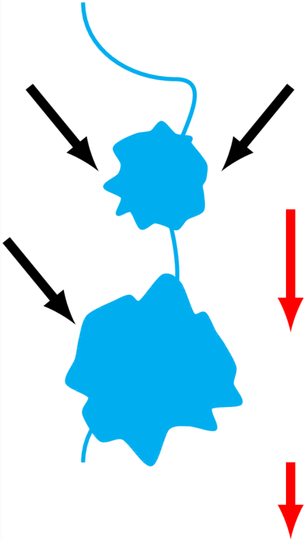
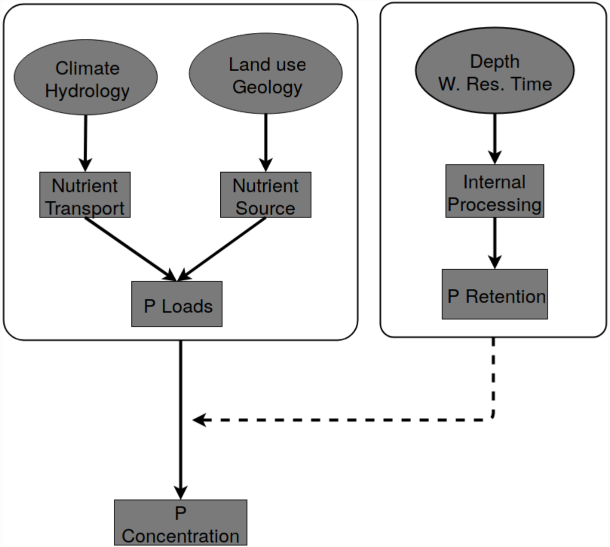
LAKE PHOSPHORUS (P) RETENTION

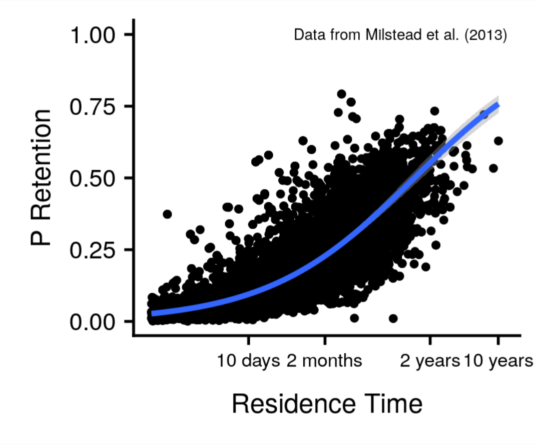


P retention directly controls downstream transport [Alexander et al., 2002]

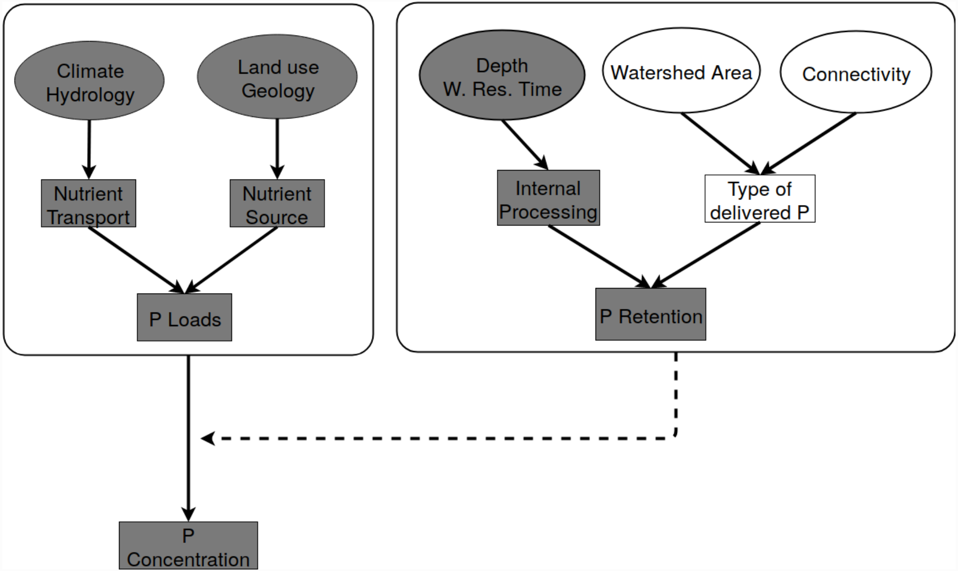
P retention indirectly controls sediment P accumulation [Søndergaard et al., 2013]

P RETENTION MODELS [Vollenweider, 1975]





EXTENDING P RETENTION MODELS



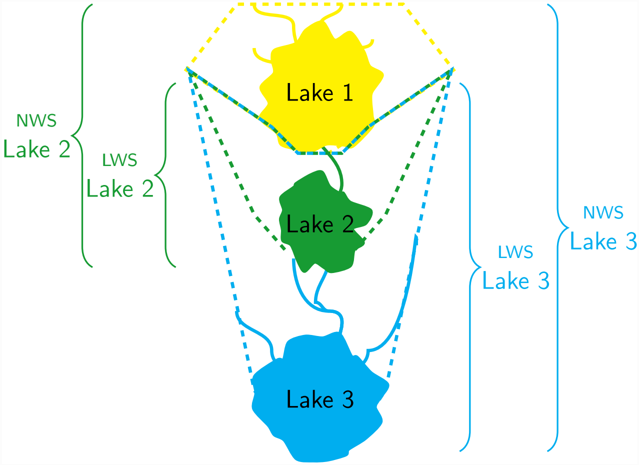
MULTIPLE WAYS TO DEFINE CONNECTIVITY

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.

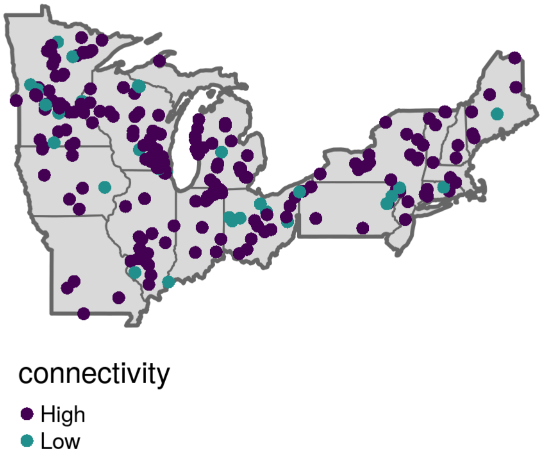
CONNECTIVITY SCALES

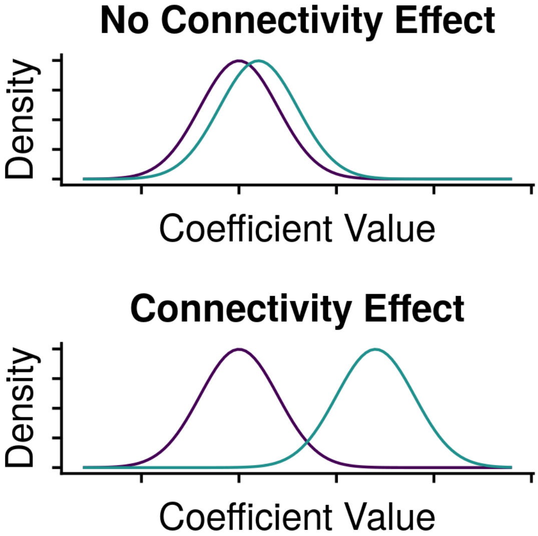


Does connectivity of lakes and their watersheds influence lake phosphorus retention?

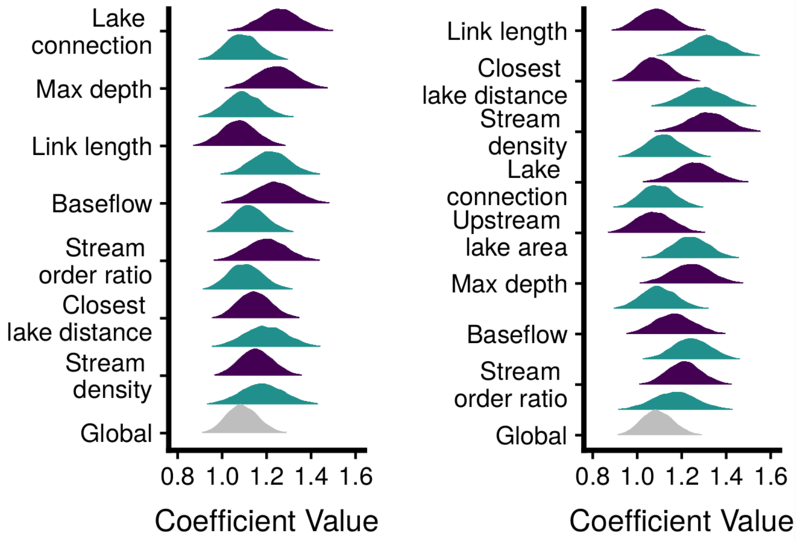
What is the relative importance of different connectivity types in determining lake P retention and what spatial extents are most important for connectivity and P retention?

METHODS


connectivity
High
Low


No Connectivity Effect
Density
Coefficient Value
Connectivity Effect
Density
Coefficient Value

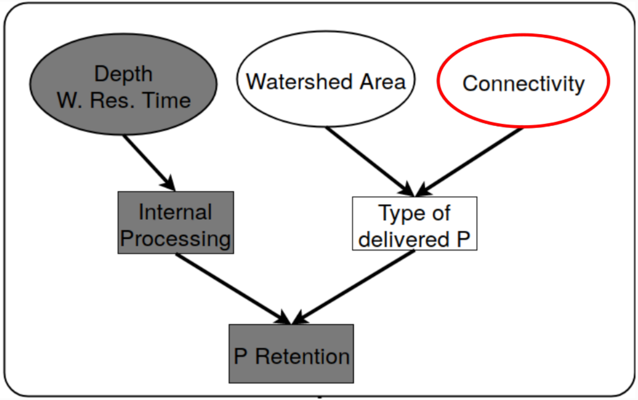
P RETENTION (PROCESSING) COEFFICIENT DISTRIBUTIONS



CONNECTIVITY METRIC IMPORTANCE

Metric	Scale	Connectivity Type	Delta k
Average link length	Network	Longitudinal	0.23
Closest lake distance	Network	Longitudinal	0.22
Stream density	Network	Lateral	0.20
Lake connection	Focal	Longitudinal	0.17
Upstream lake area	Network	Longitudinal	0.16
Max depth	Focal	-	0.15
Average link length	Lake	Longitudinal	0.14
Baseflow	Lake	Lateral	0.12
Stream order ratio	Lake	Longitudinal	0.10

DOES LAKE AND STREAM CONNECTIVITY CONTROL PHOSPHORUS RETENTION IN LAKES?



Connectivity of lakes and their watersheds is related to P retention.

Connectivity at the network scale is more important than connectivity at finer scales.

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