

Figure 1: Major lake and watershed characteristics, factors, and processes affecting lake P retention. Shaded symbols indicate items typically considered in P retention models while open symbols indicate additional items considered in the present study.

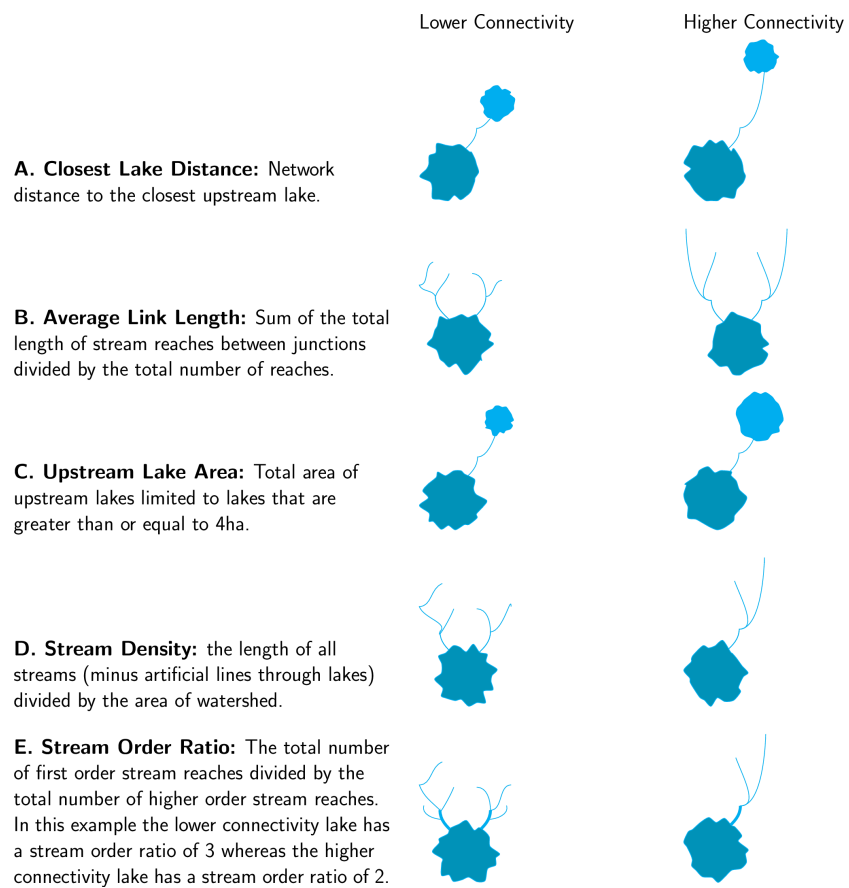


Figure 2: Connectivity metric definitions along with examples of high and low connectivity lakes.

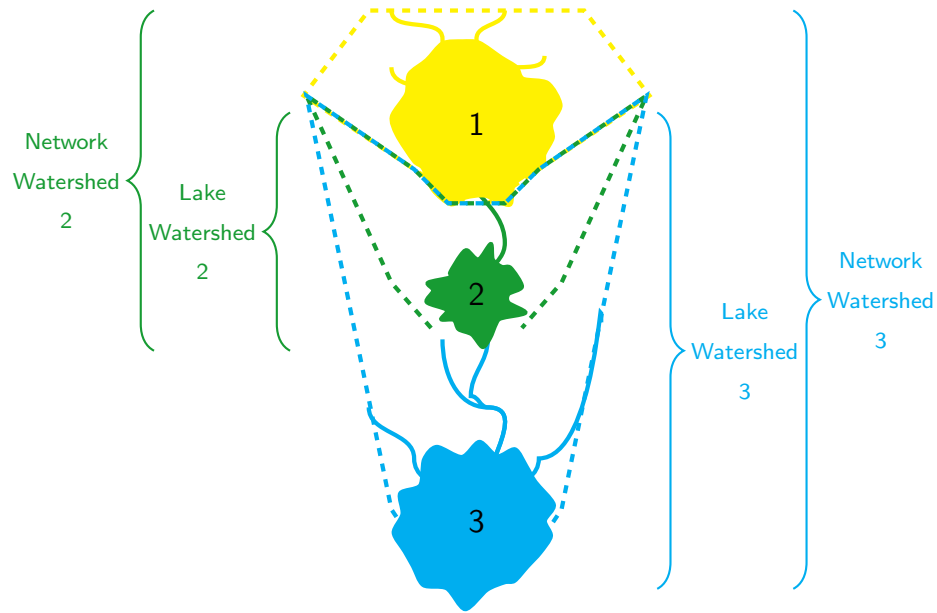


Figure 3: Diagram showing the lake watershed (LWS) and network watershed (NWS) of three lakes. Here the IWS of lake 3 encompasses the LWS of lake 2 because of it is smaller than 10 ha small size but it does not encompass the LWS of lake 1 because it has an area of at least 10 ha. In contrast to the LWS boundaries, the NWS boundaries extend to the headwaters of the lake chain.

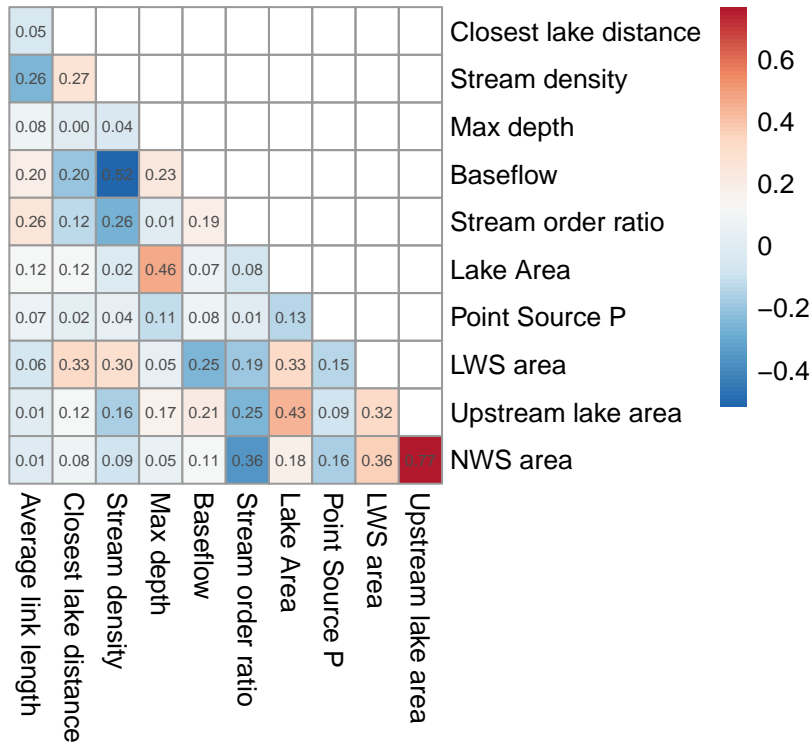


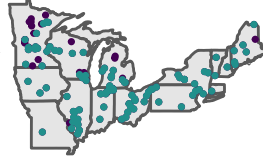
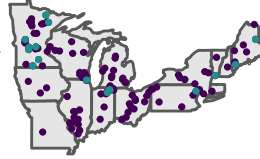
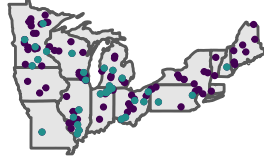
Figure 4: Correlation between connectivity metrics and selected lake characteristics.

### A. LWS

Average  
link length

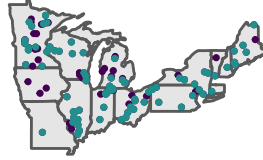
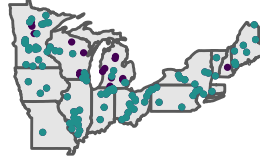
Closest  
lake distance

Stream  
density



Baseflow

Stream  
order ratio

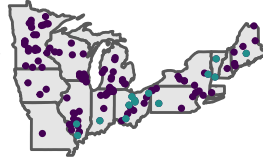
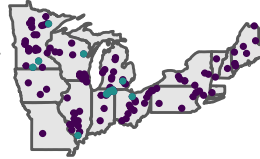
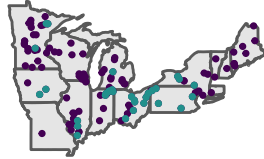


### B. NWS

Average  
link length

Closest  
lake distance

Stream  
density



Upstream  
lake area

Baseflow

Stream  
order ratio

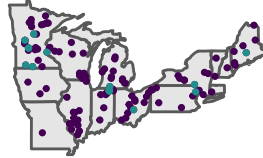
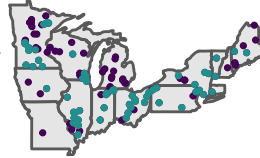
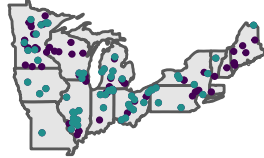


Figure 5: Maps showing the locations of lake connectivity partitions. Green symbols indicate the lower of the two partition groups while purple symbols represent the higher of the two partition groups (see Table 2).

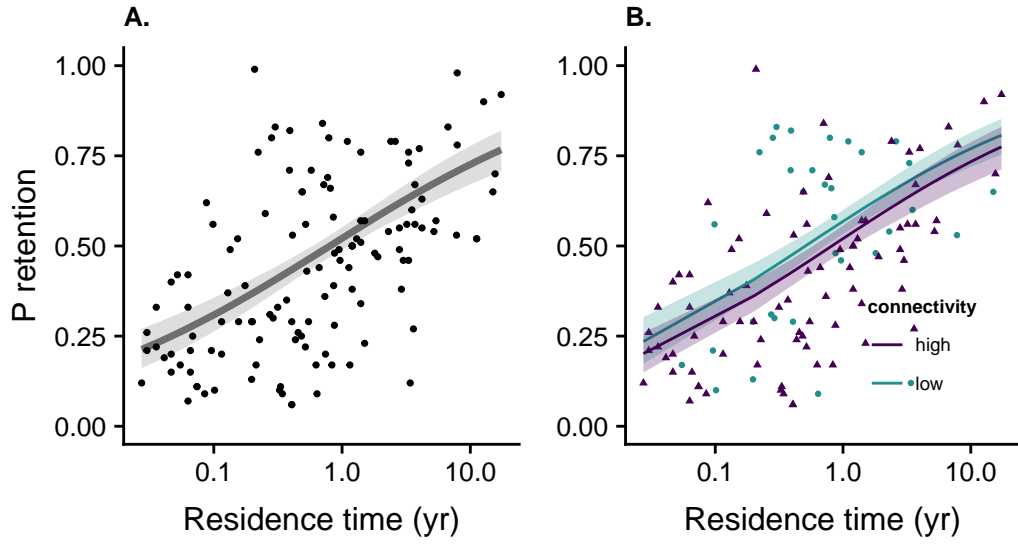


Figure 6: Residence time (yr) versus P retention for the NES dataset and the global model fit to the data where the solid line and shaded interval represents the median and central 95% interval estimates respectively.

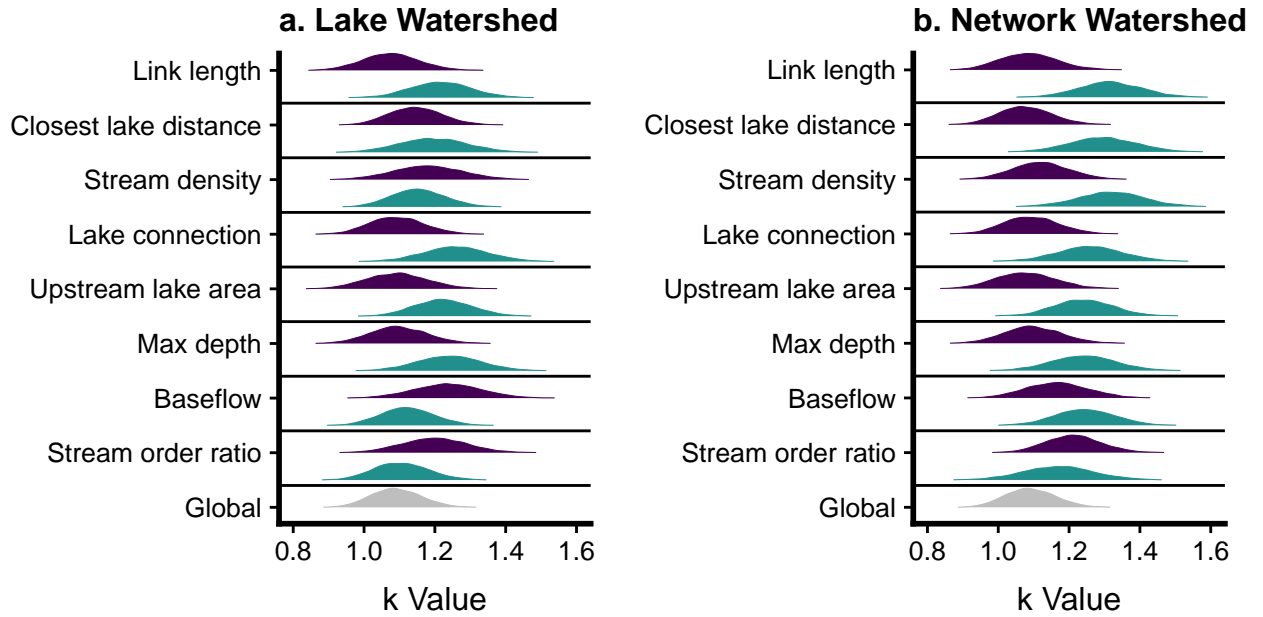


Figure 7: Distribution of the  $k$  parameter from the Vollenweider's equation in low and high connectivity partitions at the (A) LWS and (B) NWS scales. Green symbols indicate the lower of the two partition groups while purple symbols represent the higher of the two partition groups (see Table 2).