

Seasonal Streamflow Changes in Wisconsin Watersheds

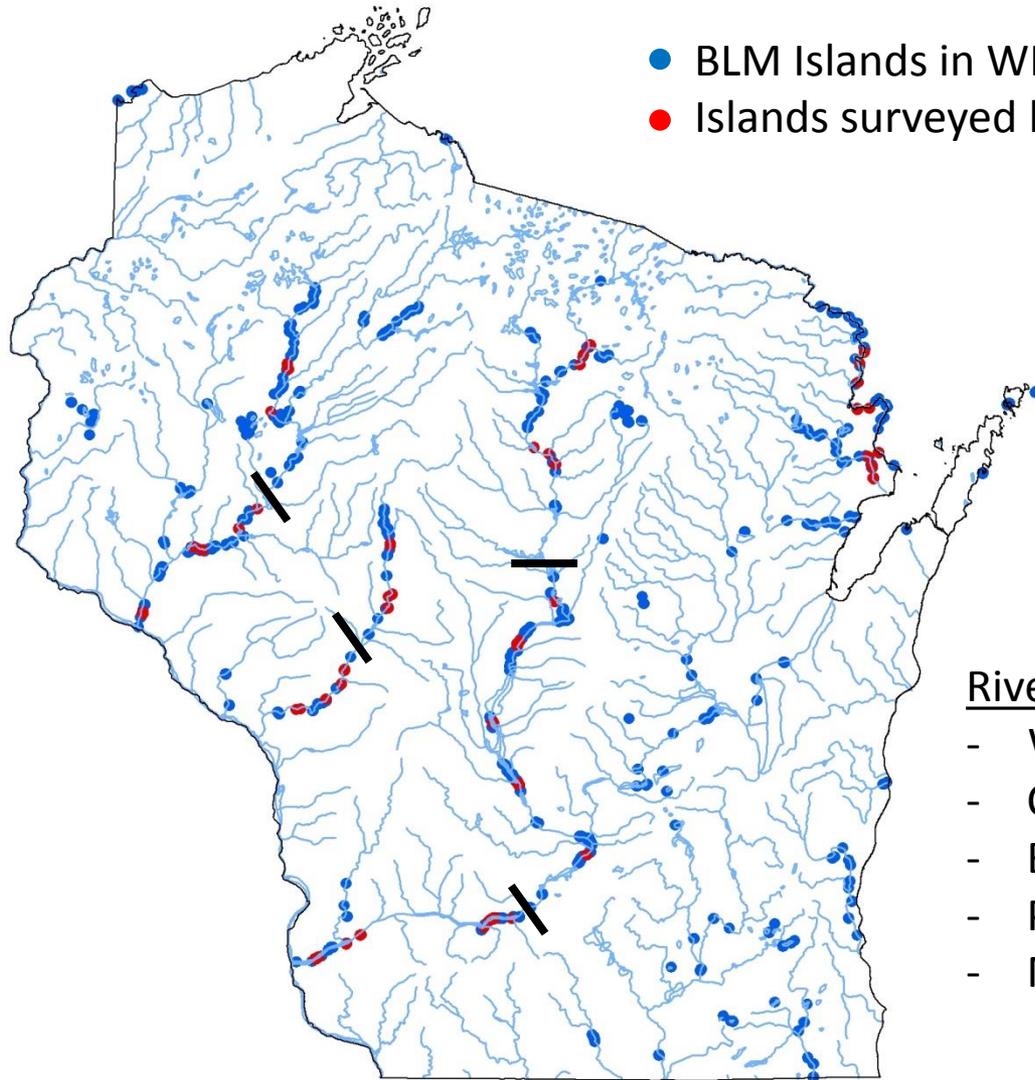
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Natural Heritage Inventory



- BLM Islands in WI (N= ~597)
- Islands surveyed by NHI (N=52)

Rivers Surveyed

- Wisconsin (Upper, Middle, Lower)
- Chippewa (Upper, Lower)
- Black (Upper, Lower)
- Peshtigo
- Menominee

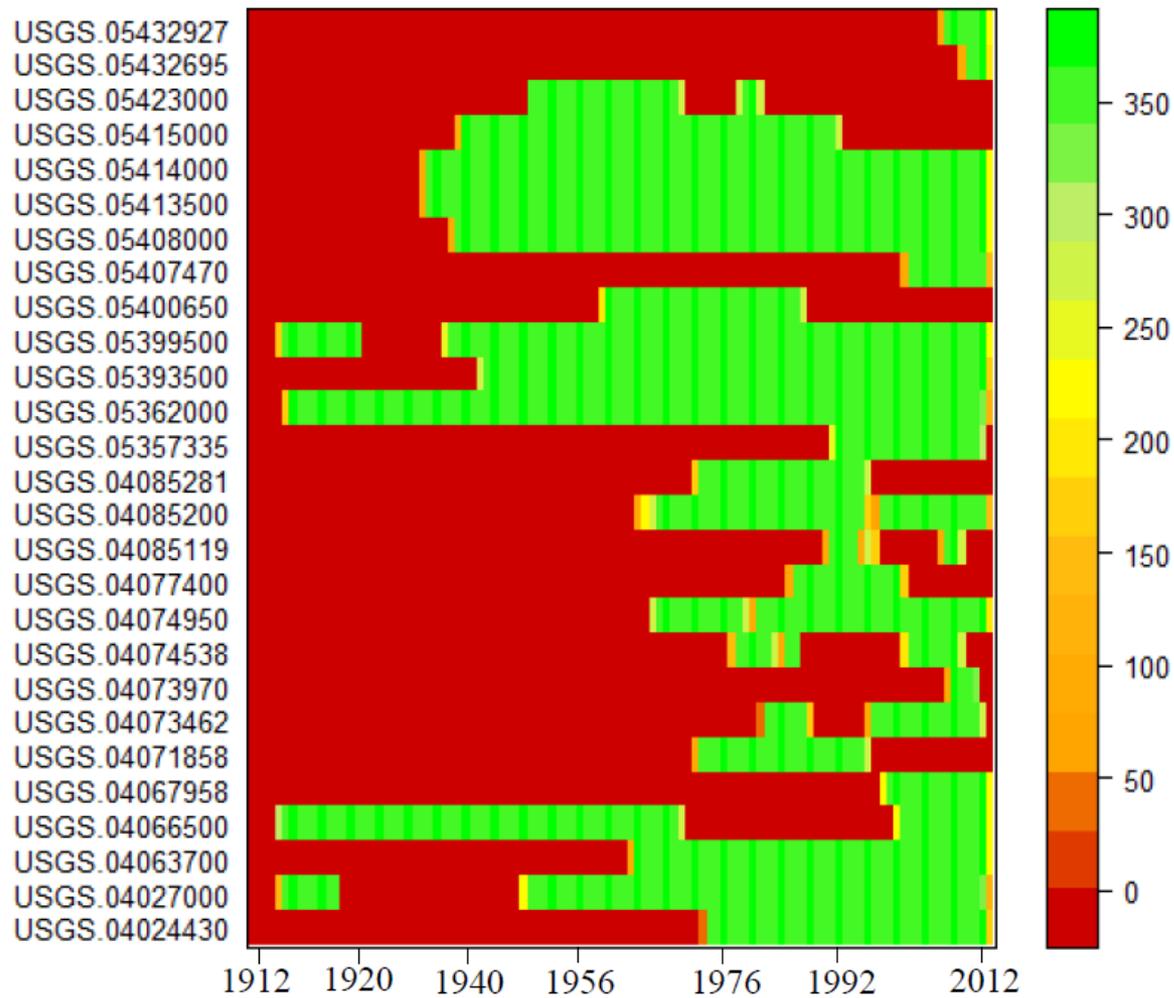
Outline

- Streamflow change analysis

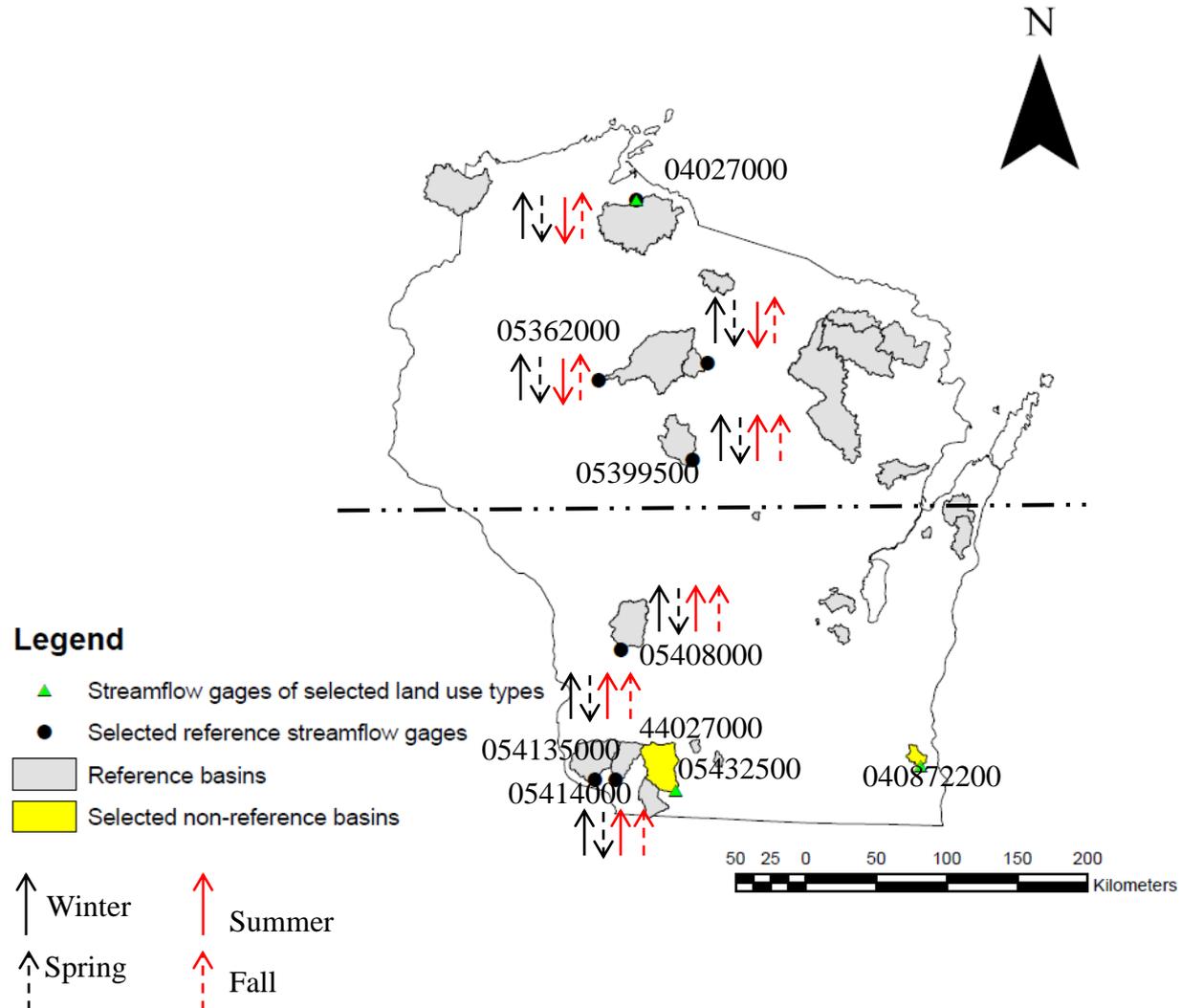
Reference and Non-Reference Gages -GAGES II dataset (Falcone et al. 2012)

- PET based method to apportion changes due to climate and land use
- Future changes in hydrology

Streamflow record of reference basins in WI

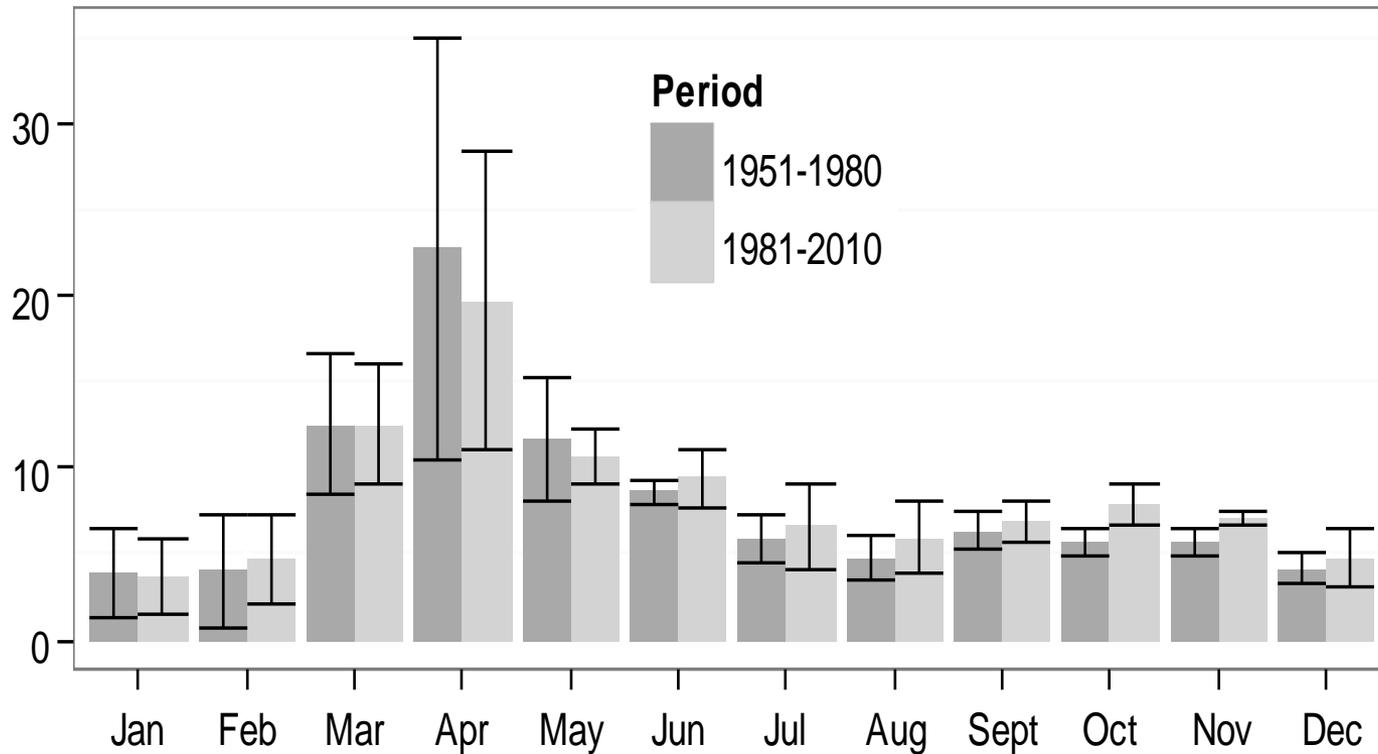


Streamflow change analysis



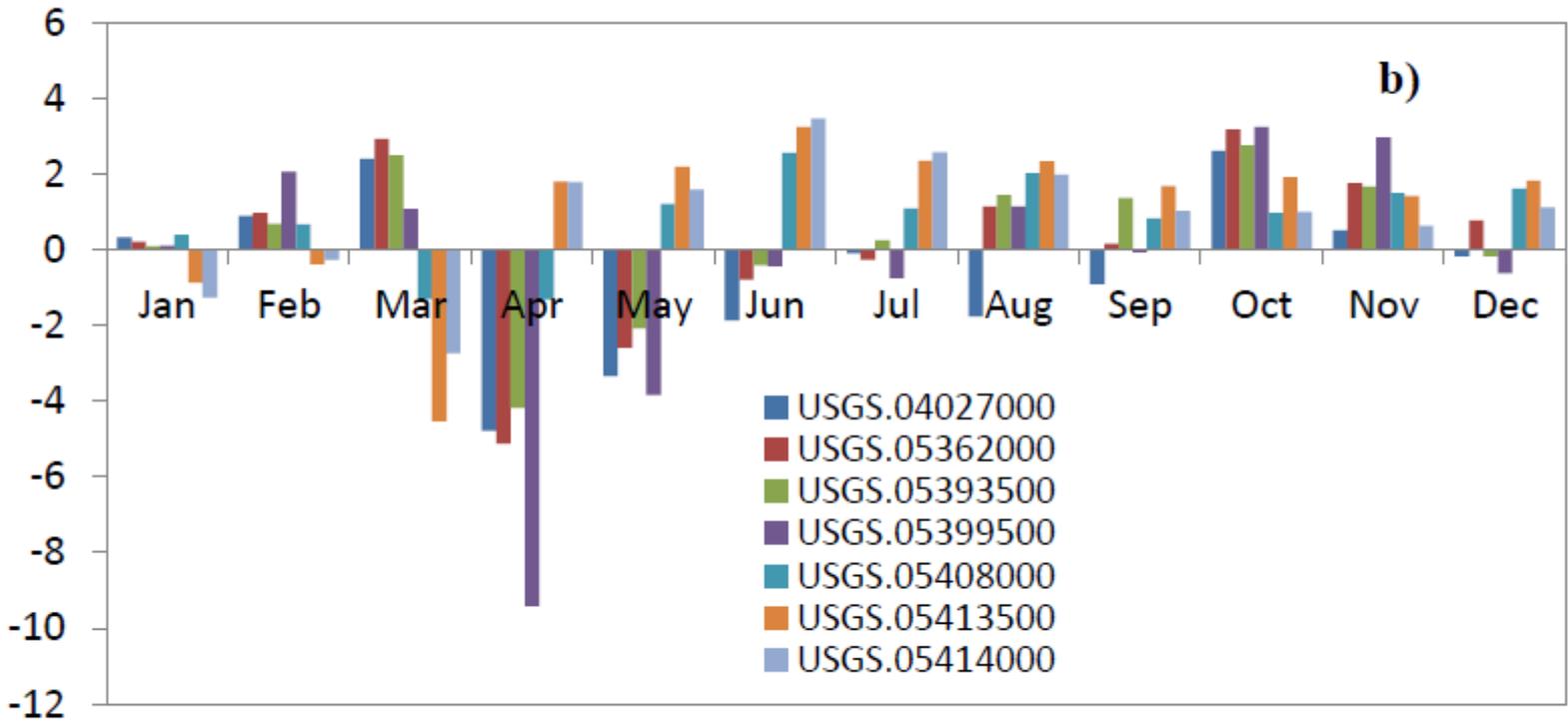
Streamflow change analysis

Monthly runoff expressed as a percentage of annual runoff

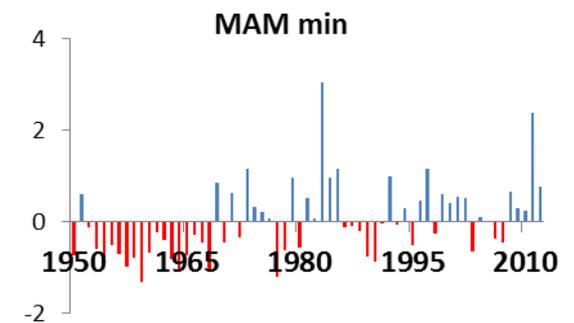
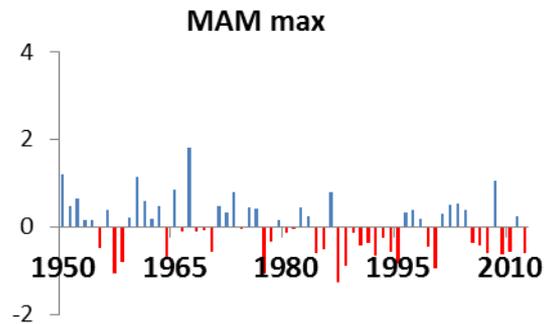
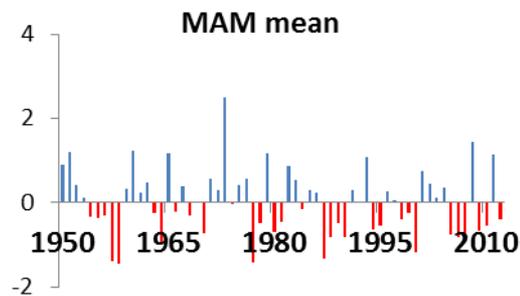
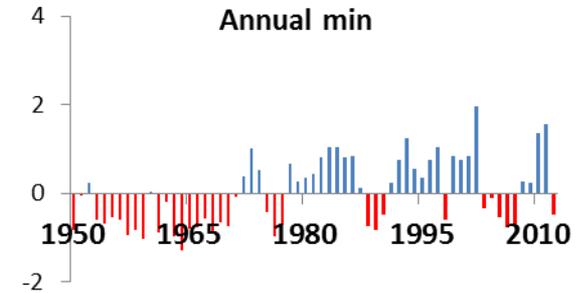
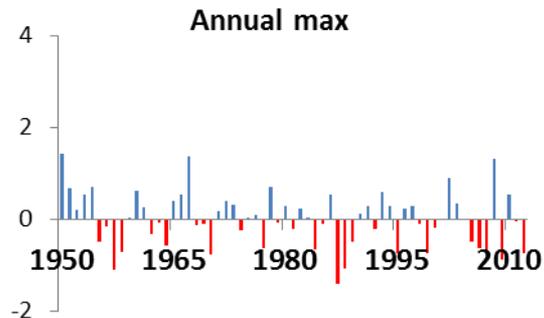
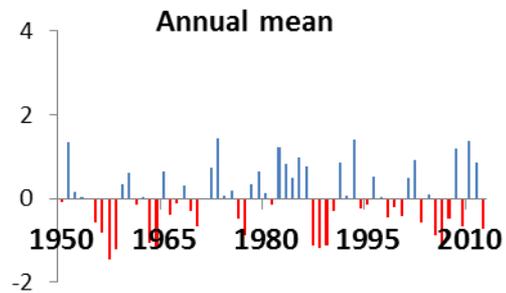


Streamflow change analysis

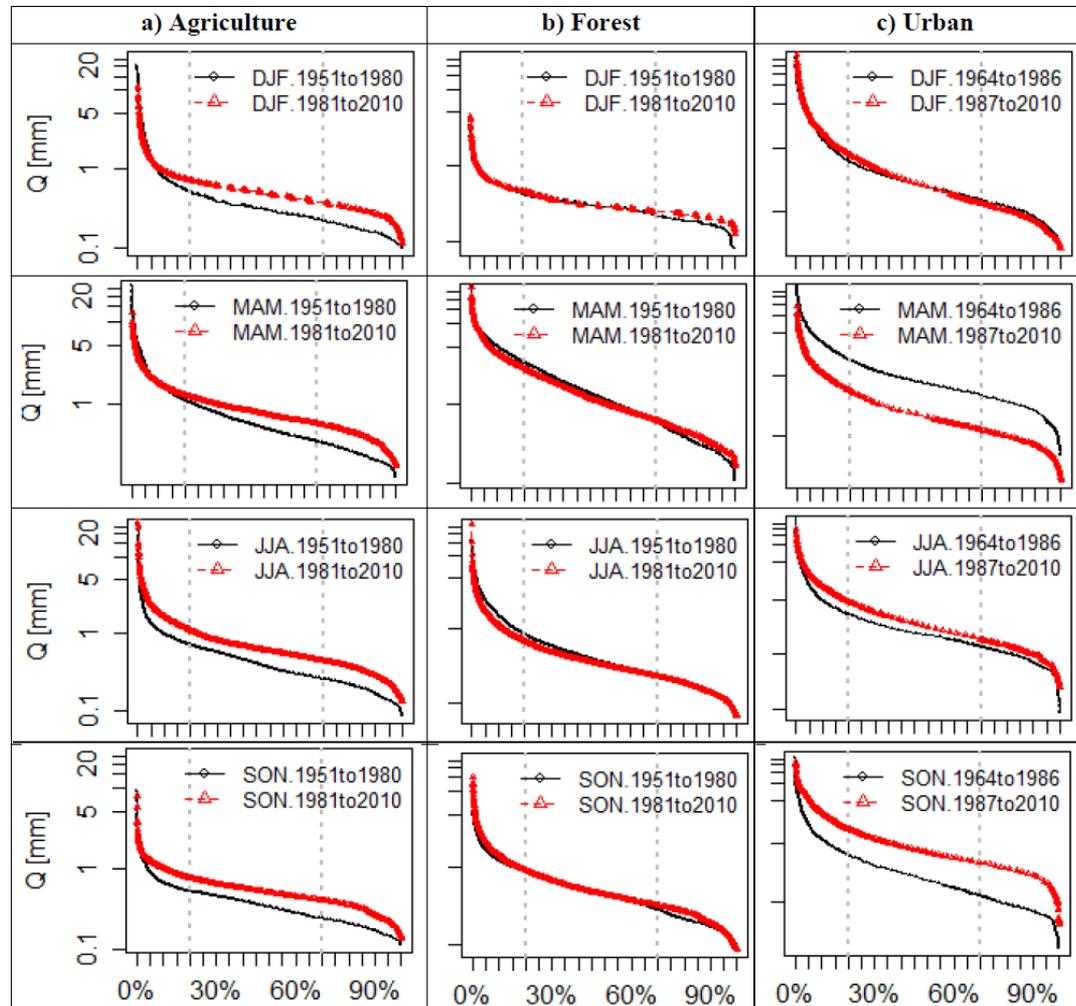
Percent change in monthly runoff between periods (1981-2010) and (1951-1980)



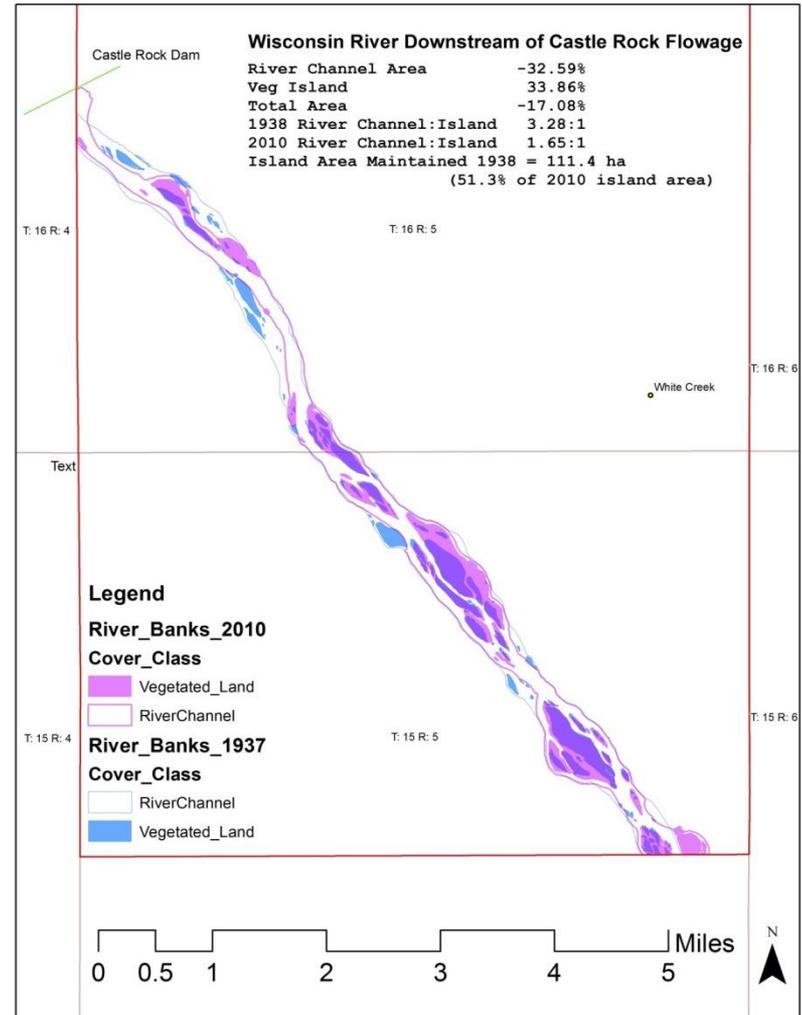
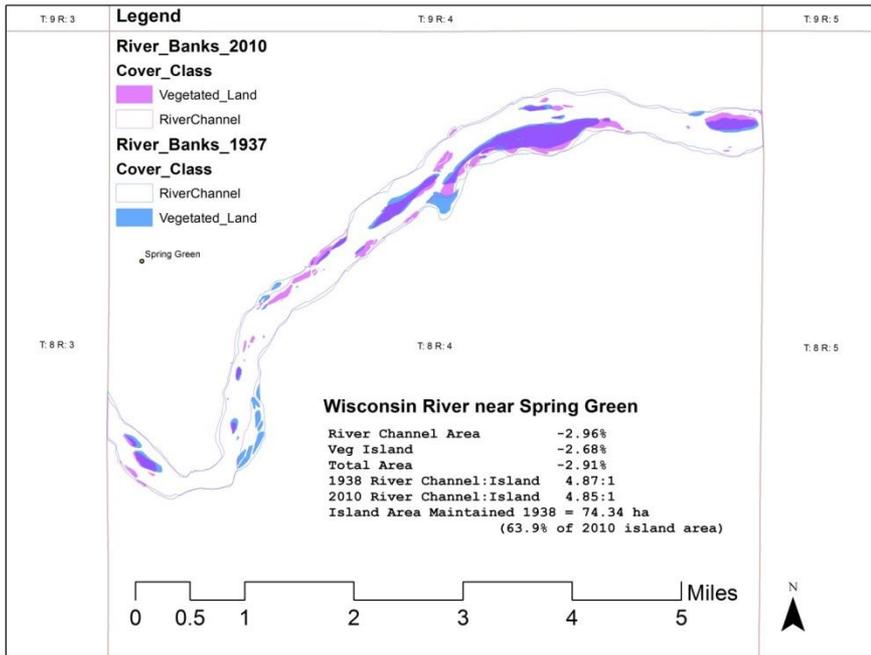
Standardized departures from normals



Flow duration curve analysis



Geomorphological changes in river islands



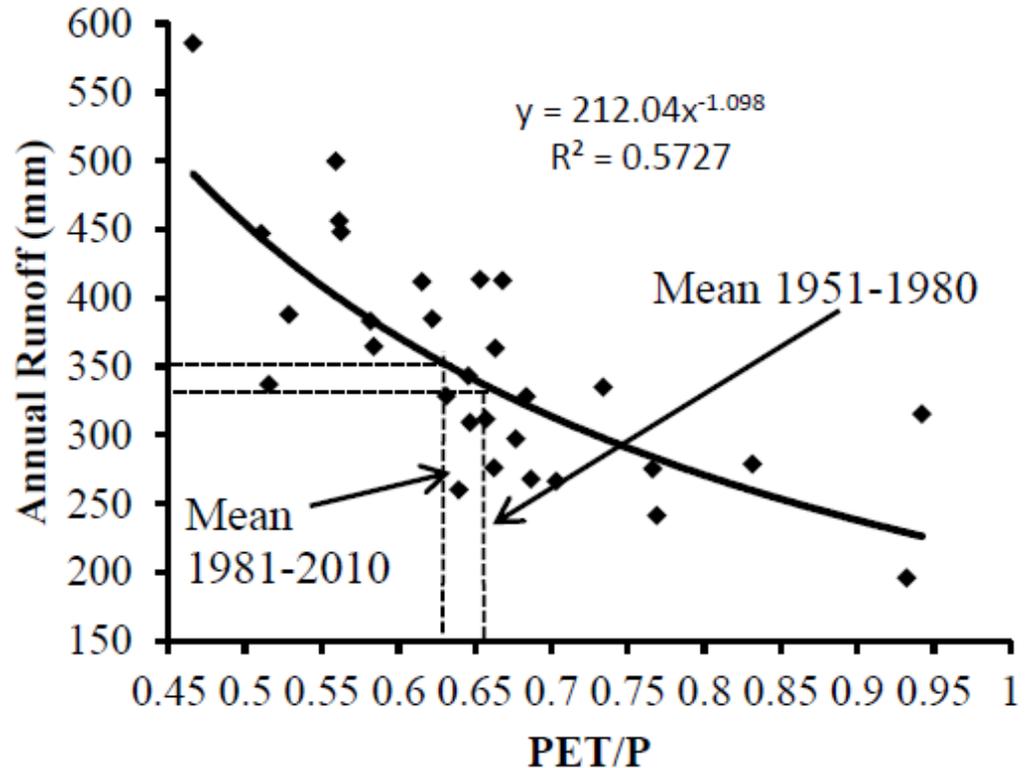
Maps made by: Chris Noll

Apportioning changes to climate and land use

$$\Delta ET_{\text{climate}} + \Delta ET_{\text{landuse}} + \Delta ET_{\text{other}} = \Delta P - \Delta Q$$

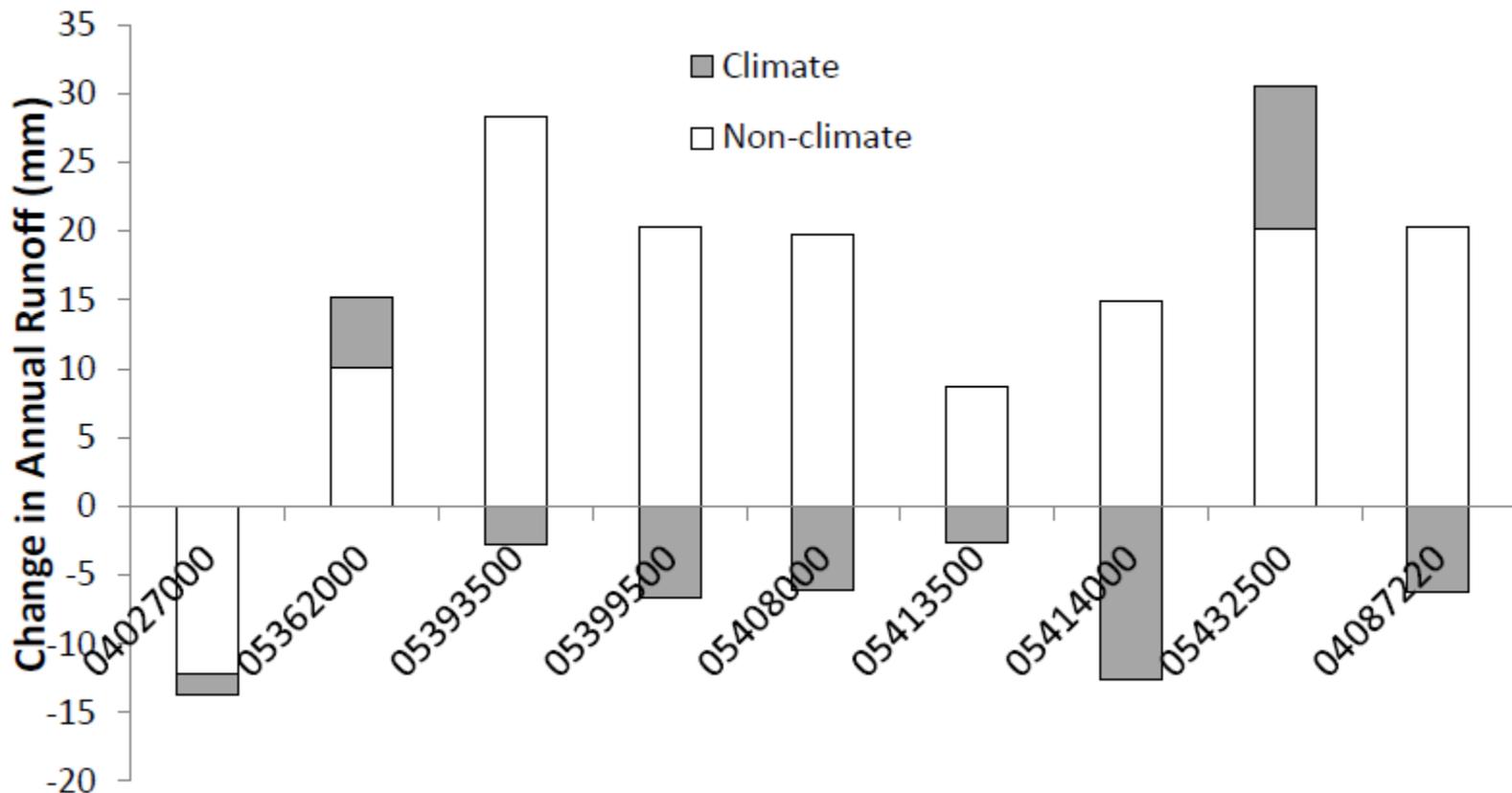
$$Q = C \times (PET/P)^{-B}$$

$$\Delta Q_{\text{climate+landuse}} = C \times ((PET/P)^{-B}_{(1981-2010)} - (PET/P)^{-B}_{(1951-1980)})$$



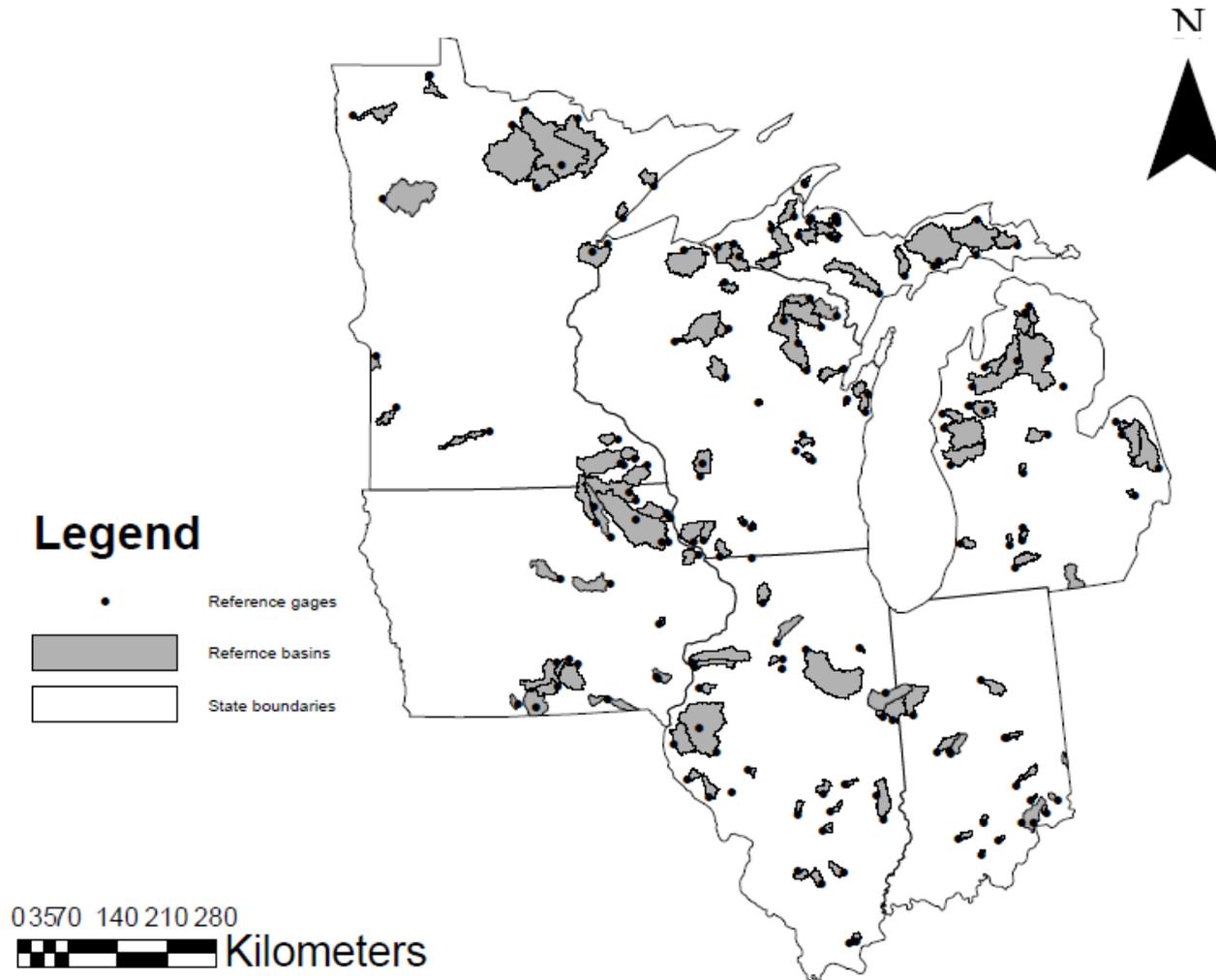
Empirical relationship between runoff and the ratio of PET to precipitation using annual values for the 30 year earlier historic period (1951-1980): an example for Bad River near Odanah, WI (04027000). The dashed line represents the annual runoff corresponding to PET/P ratio for the calibrated (1951-1980) and predicted (1981-2010) periods.

Apportioning changes to climate and land use

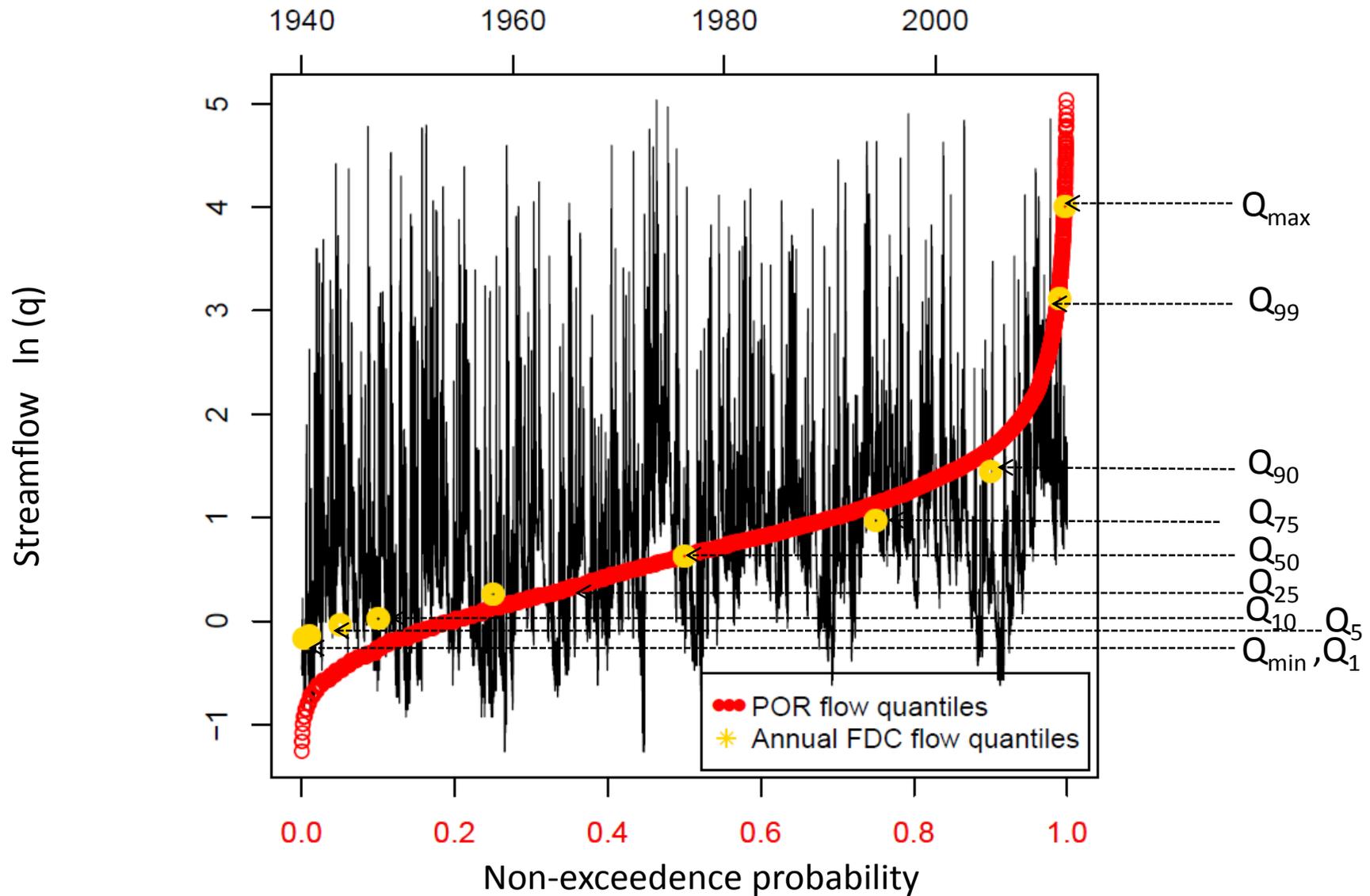


Apportionment of changes in mean annual runoff for reference and non-reference basins considered. Non-climatic factors account for more than half of the total change in annual runoff in all basins.

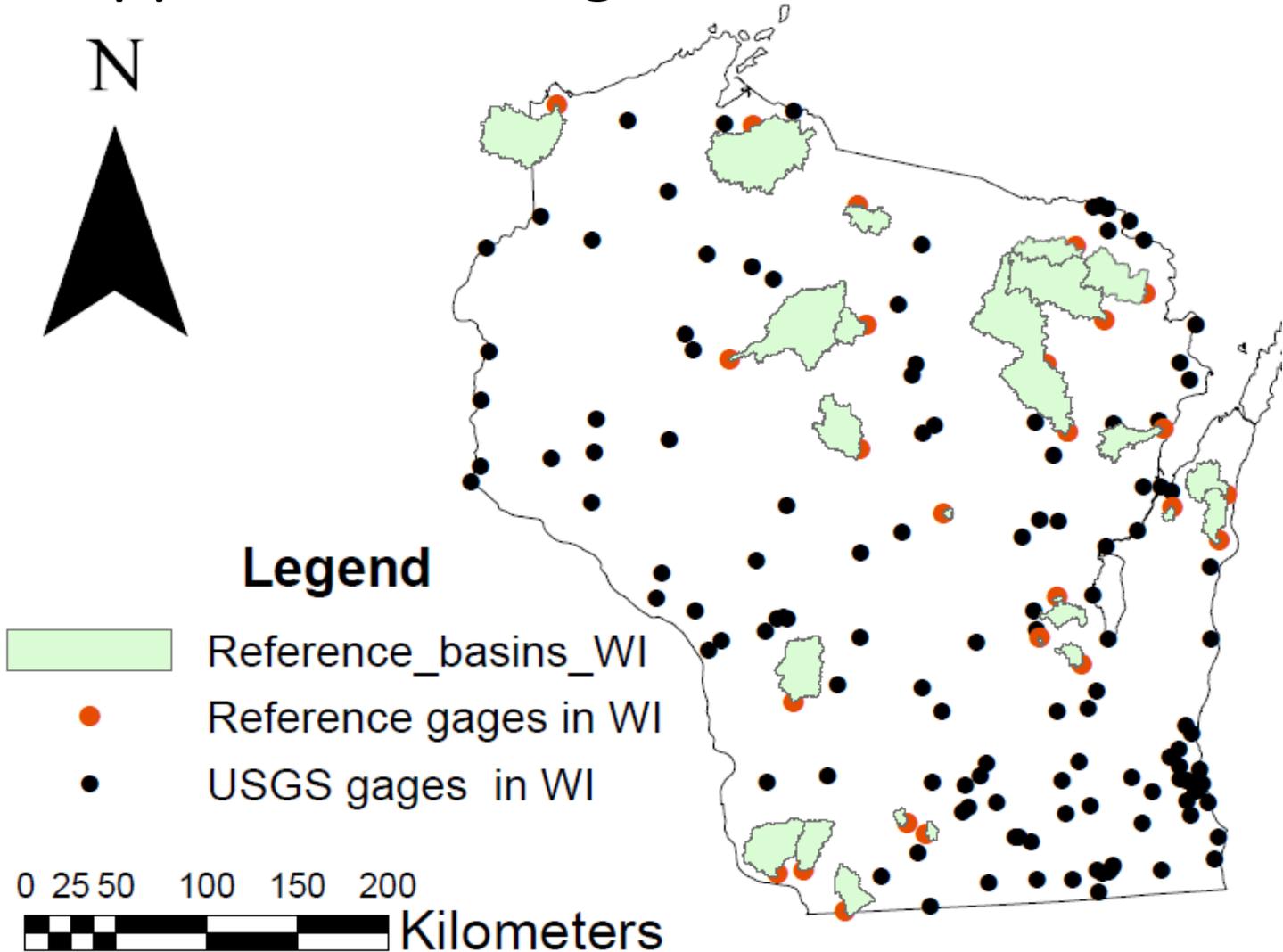
Regional regression model



Flow duration curves



Application of regression models



Conclusion

- Comparison of annual and seasonal statistics showed more pronounced seasonal differences than analysis focused on annual statistics.
- Significant patterns were not identified for mean and maximum flow statistics but the magnitude of positive departures were found higher than negative.
- Hydrologic and regression modeling are being used as tools to link hydrologic changes to changes in river islands.

Questions?

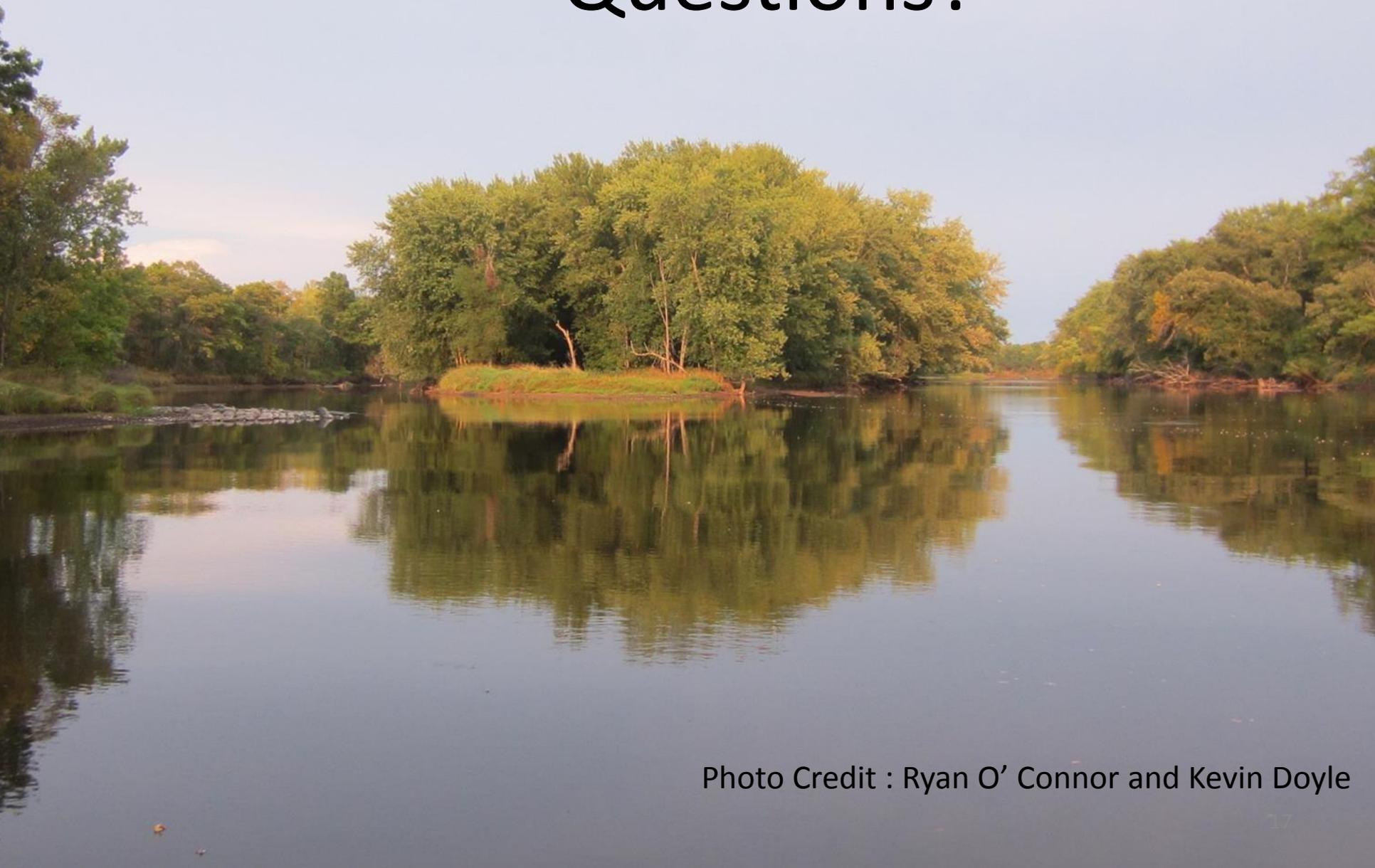


Photo Credit : Ryan O' Connor and Kevin Doyle