Regional climate is the primary determinant of in-stream hydrologic regime in the Pacific Northwest (PNW). Climate models predict winter warming to increase precipitation falling as rain and decrease snowpack, translating to increased winter runoff and reduced summer discharge. Such changes to the magnitude and timing of flow ultimately affect the supply and transfer of nutrients, particularly nitrogen (N), the element critical to ecosystem function and water quality. Contrasting responses of different hydrologic regimes to changing precipitation are likely to impact the source contributions of N, along with the seasonality of N loads due to changing peak flows. To assess the impact of climate-altered hydrology to riverine N conditions in the PNW, this study seeks to determine how sources of N change seasonally and during extreme drought across rivers of varying watershed characteristics and hydrologic type (snow-fed vs. rain-snow-fed vs. rain-fed).

This study leverages monthly river water samples taken during a record drought in the PNW (2015) and a near normal hydrologic year (2016). Samples were taken from 17 different rivers across Western Washington that range in degree of landcover and in hydrologic regime (urban vs. forest vs. agriculture and rain-fed vs. glacier-fed hydrology), and processed for triple isotopes of nitrate (δ15N, δ17O, and δ18O) to determine relative N sources. We apply a series of linear models to quantify the influence of physical and watershed characteristics on riverine N conditions, synthesizing isotopic data, fine-scale land cover data, and local flow classification across the two contrasting hydrologic years. Preliminary modeling results reveal riverine N sources differ with respect to land-use and physical watershed characteristics and these differences are somehow related to river hydrologic type. High variation in isotopic signatures is also seen across season and between drought and normal conditions of river flow. These results suggest anticipated changes to hydrologic flow class under future climate change may dictate the seasonality and source of riverine N inputs to the Puget Sound, highlighting the use of isotopic data as a potential tool for water resource management.