Landscape, land-use and climatic factors influencing Nitrogen speciation across the Chesapeake Bay watershed – Preliminary analyses

Modeling Workgroup Quarterly Review
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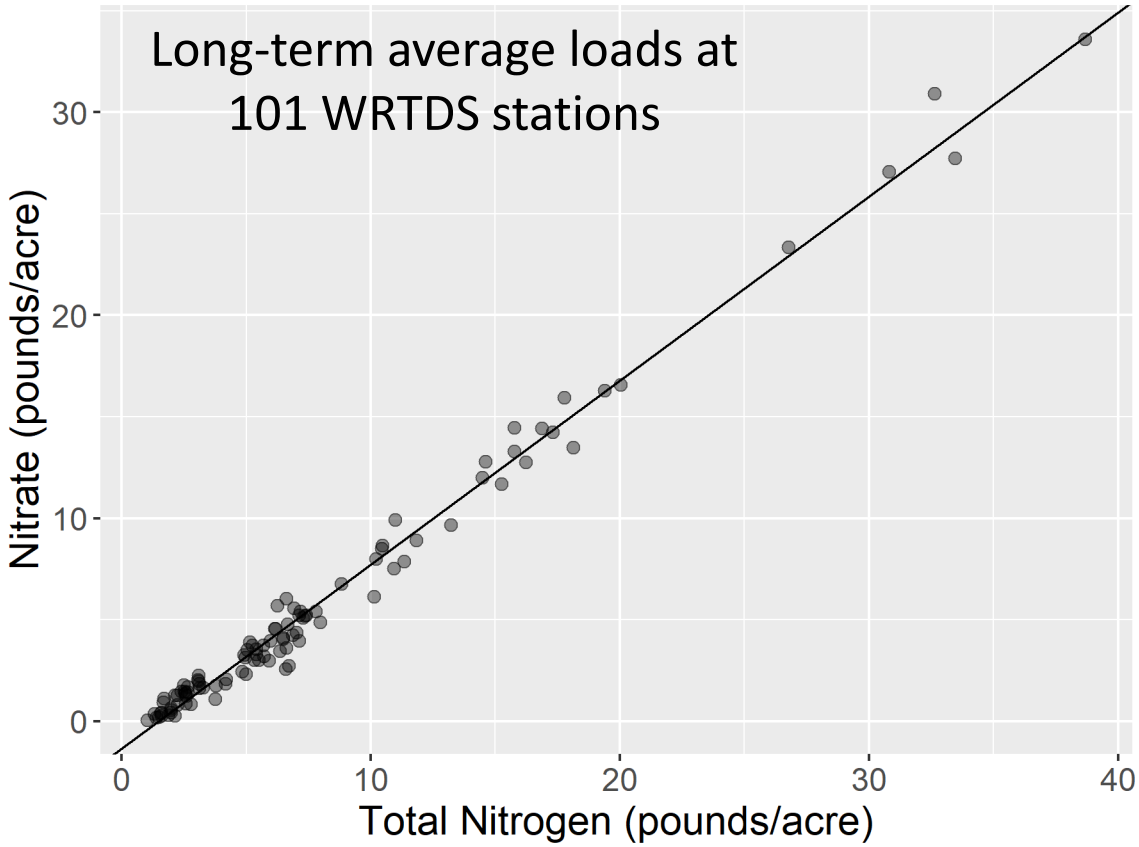
Nitrogen speciation in the CBP watershed model



- Used to estimate the fraction of EOR TN that is NO23
- Used to estimate NO23 fraction as TN loads are modified by **climate change**
- STAC 2018 CC Workshop: Relationship likely confounded/driven by spatial differences in land use rather than climate/hydrology

Nitrogen speciation in the CBP watershed model

Main objectives:

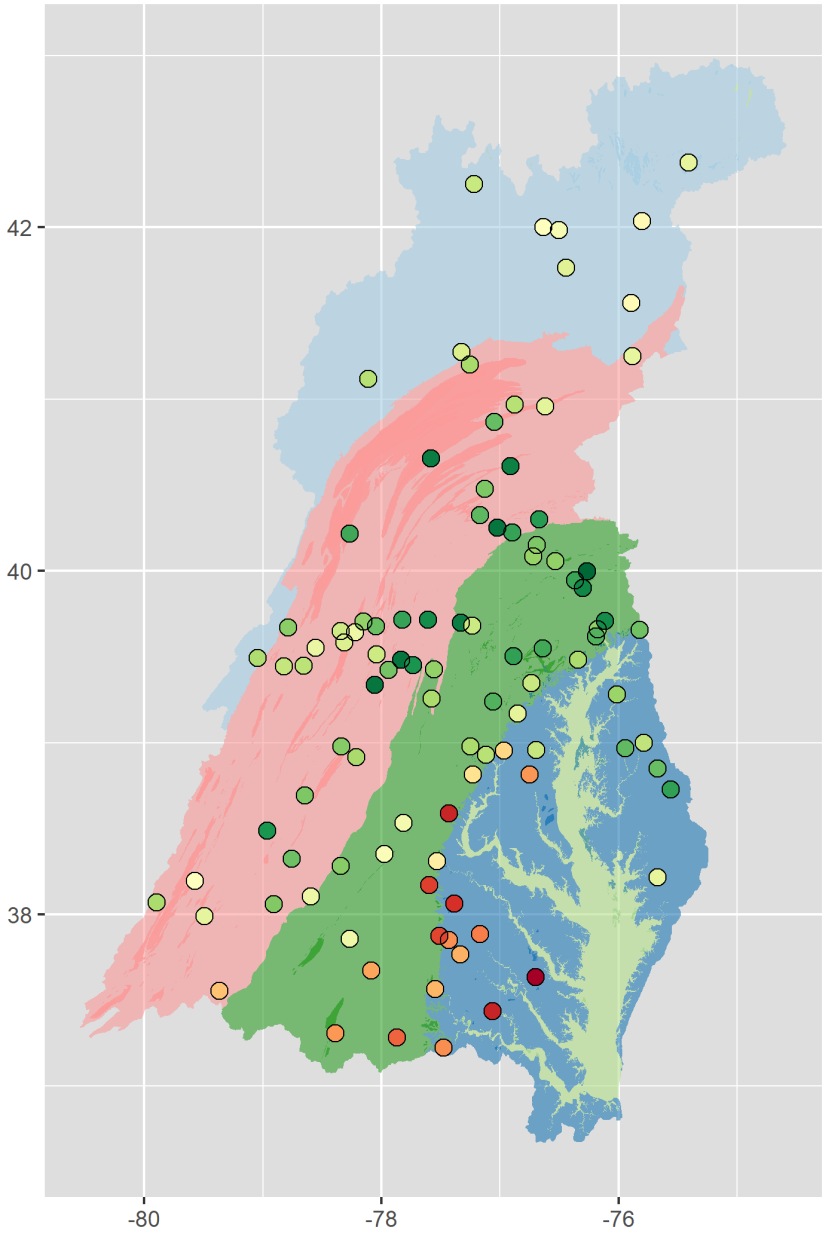
- Understand factors driving differences in N speciation across the CB watershed

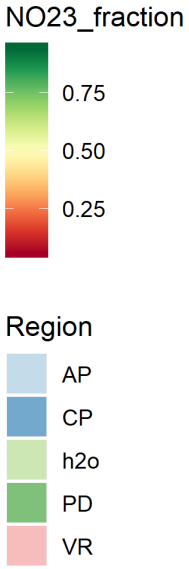
- Separate the effects of spatial factors vs climate-related variables (e.g., temperature, precipitation, flow)

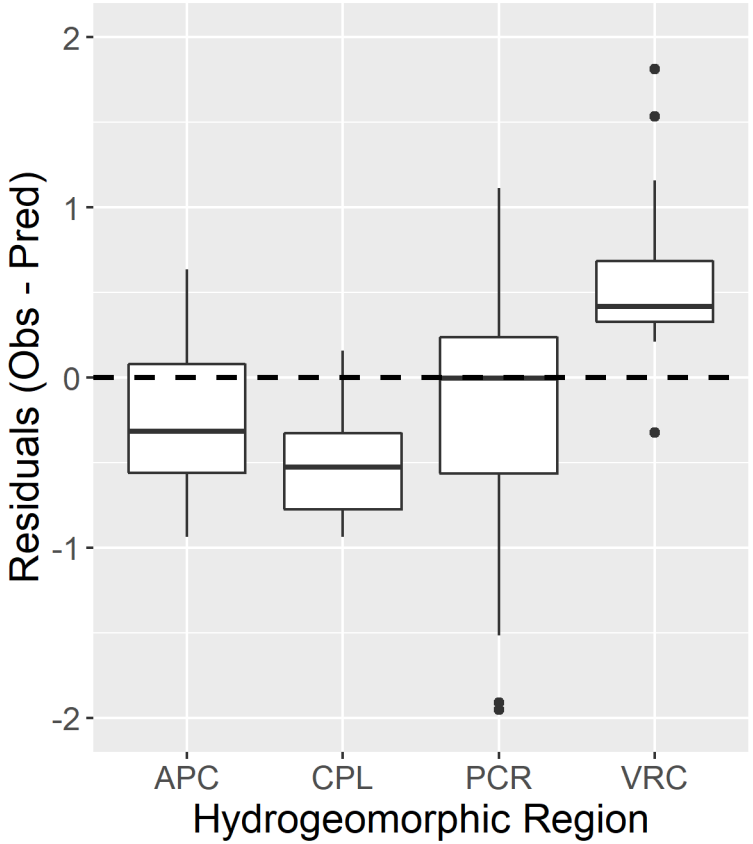
Candidate predictors of N speciation

- **Climate** variables: temperature, precipitation
- **Land-use** variables: %crop, %developed, %pasture, %natural, TP/TN ratio
- **Hydrogeology and landscape** variables: SPARROW land-to-water (groundwater recharge, soil available water capacity, enhanced vegetation index, % of piedmont carbonate) and stream-to-river (in-stream decay) DVFs, hydrogeomorphic regions

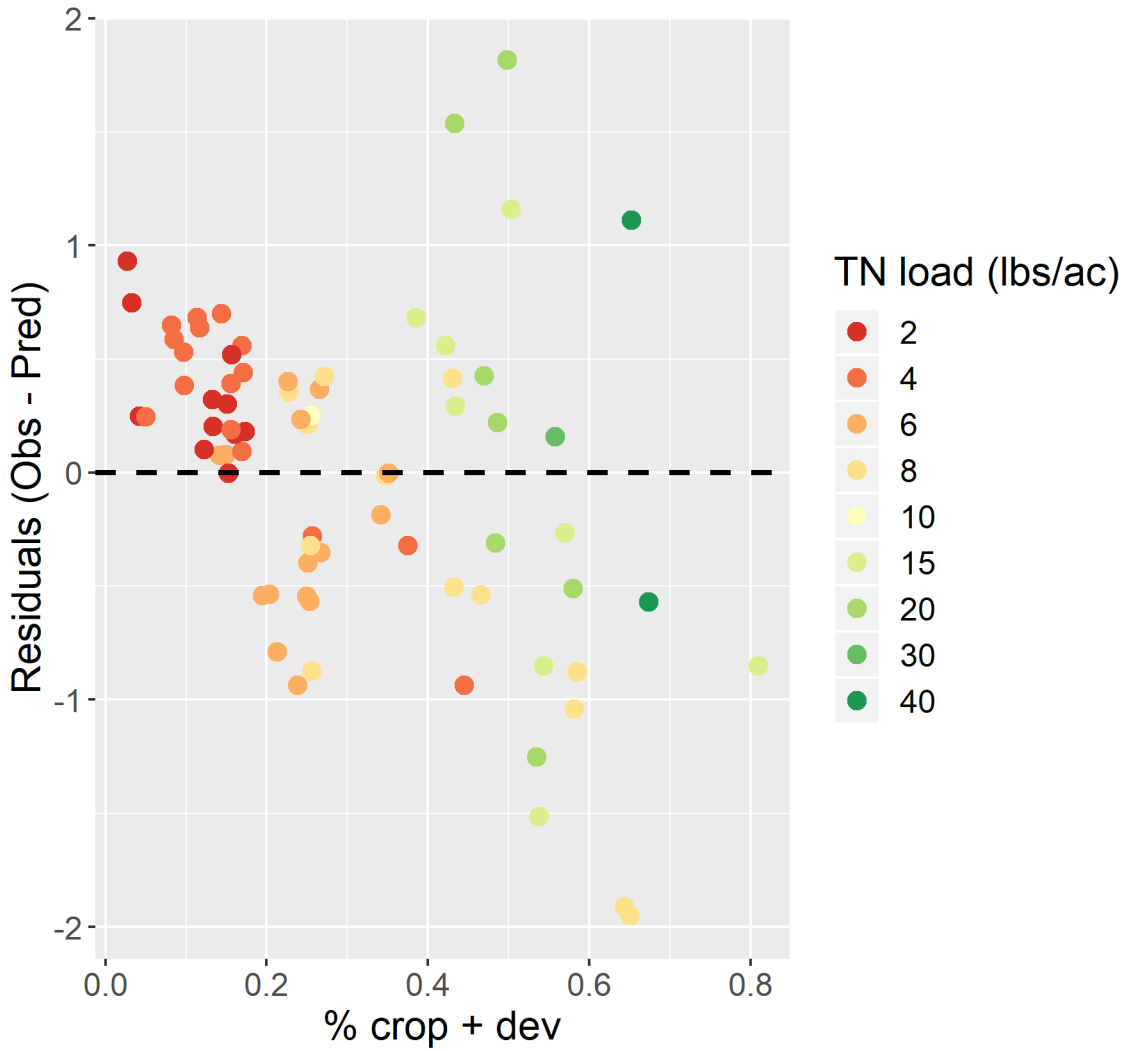
Candidate predictors of N speciation







Candidate predictors of N speciation



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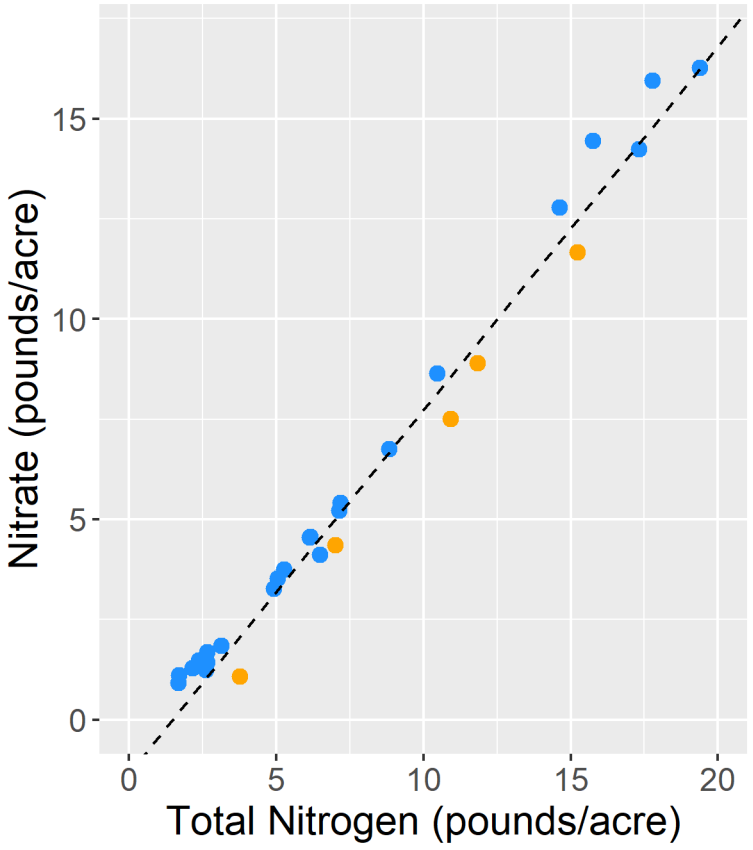
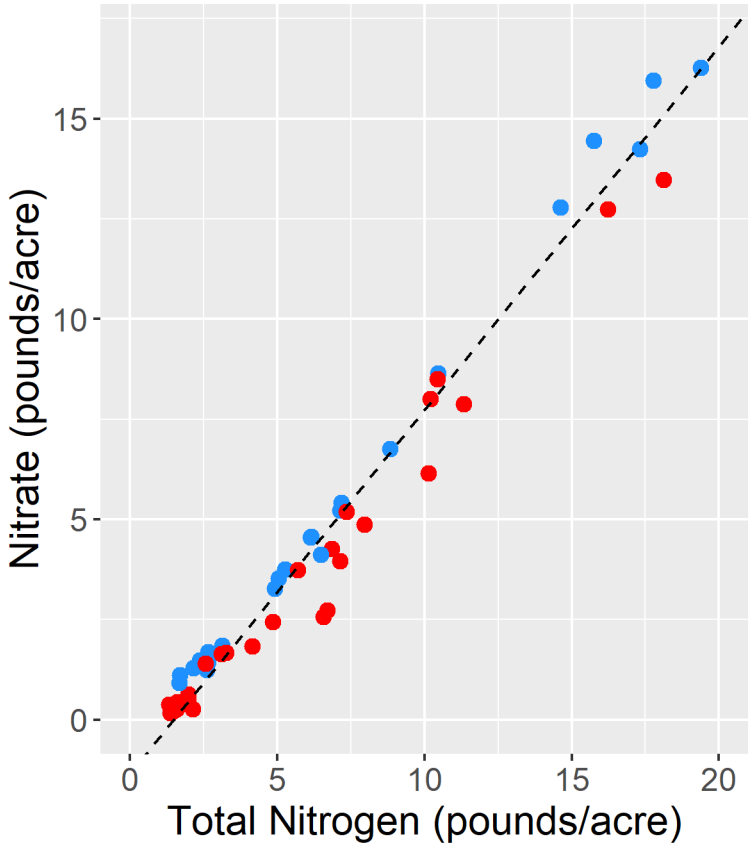
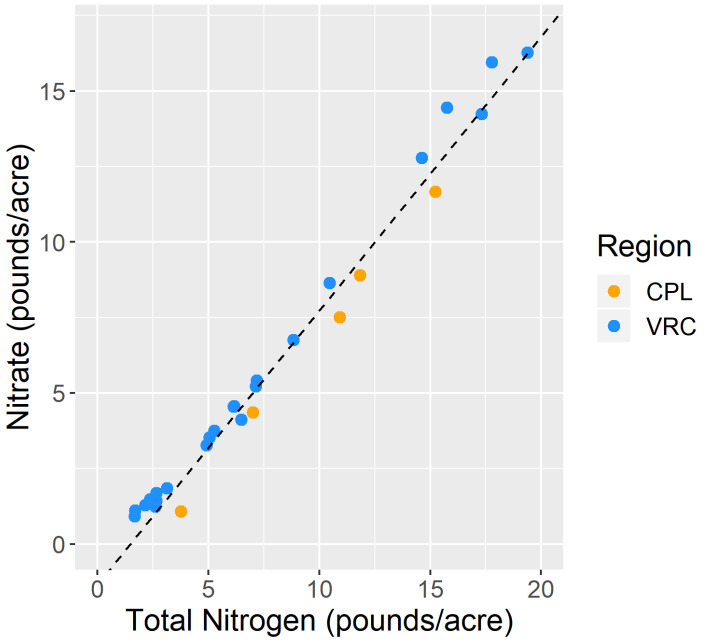
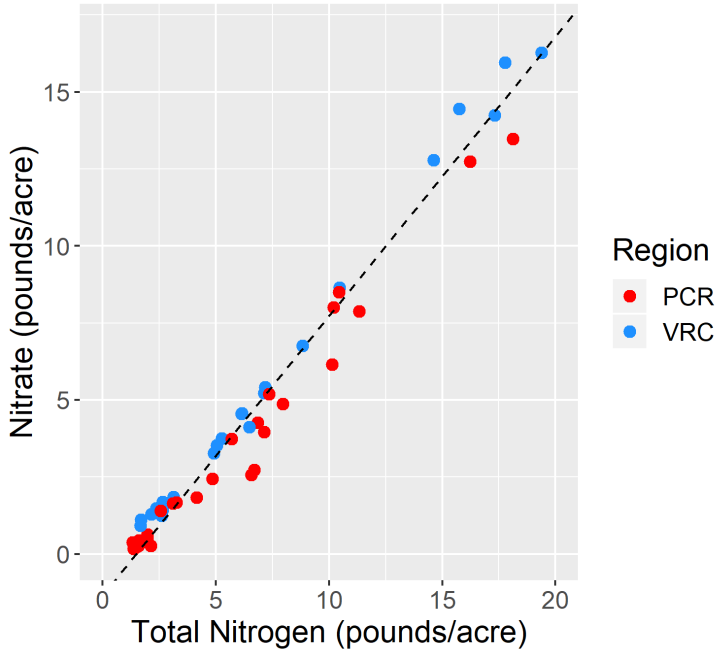
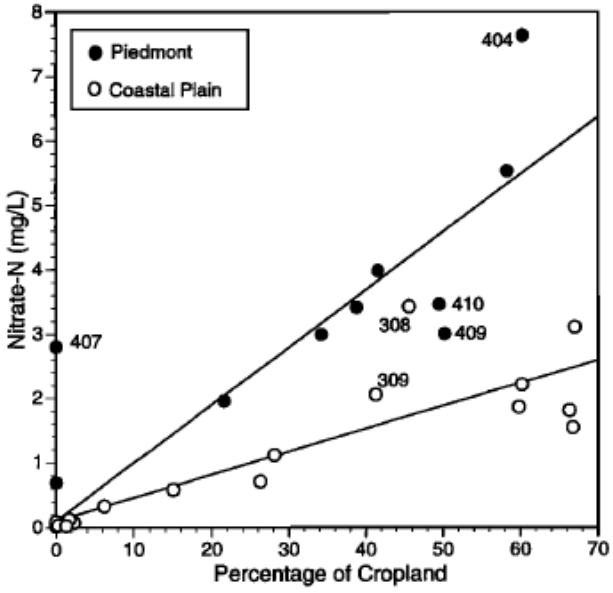




Candidate predictors of N speciation

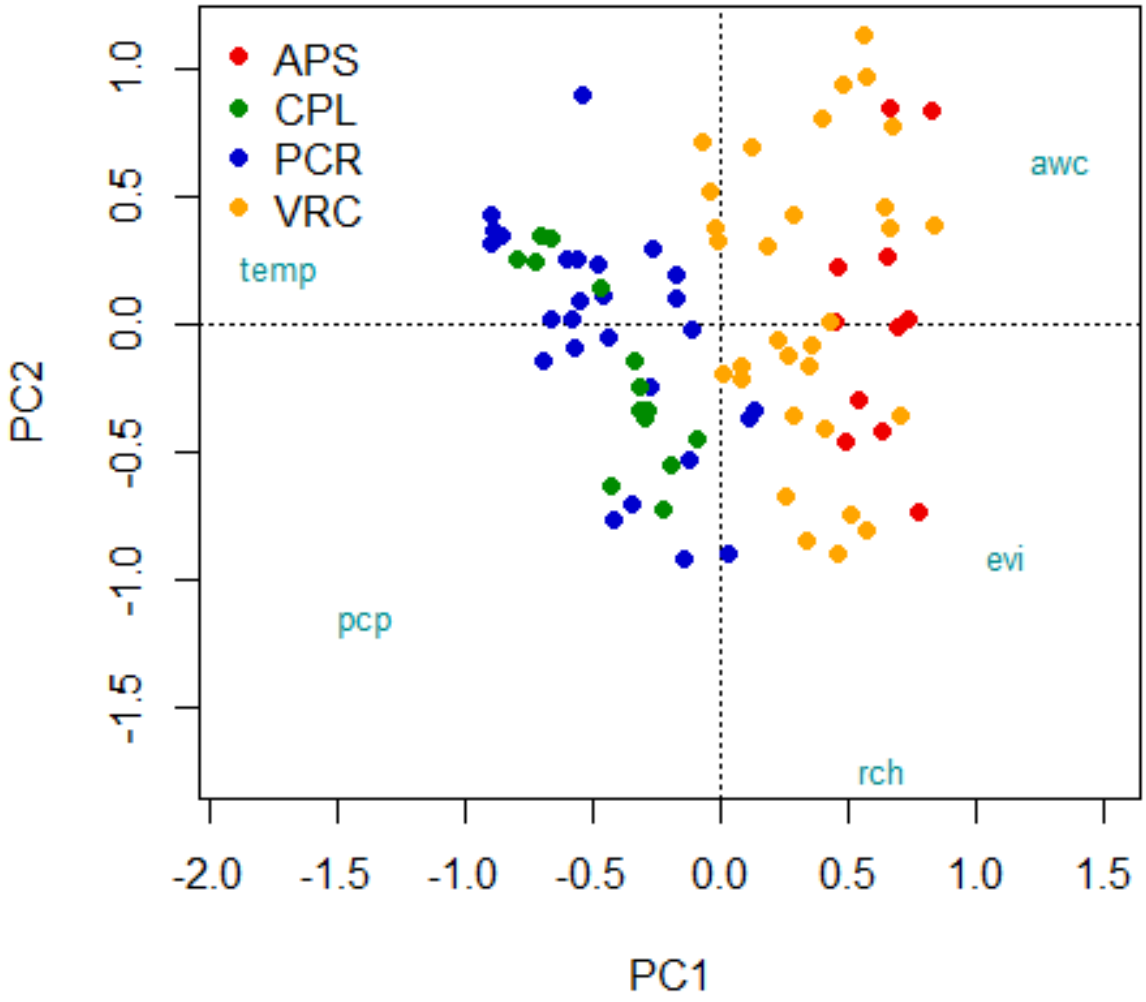






Jordan et al. 1997

Candidate predictors of N speciation



Regression model formulation

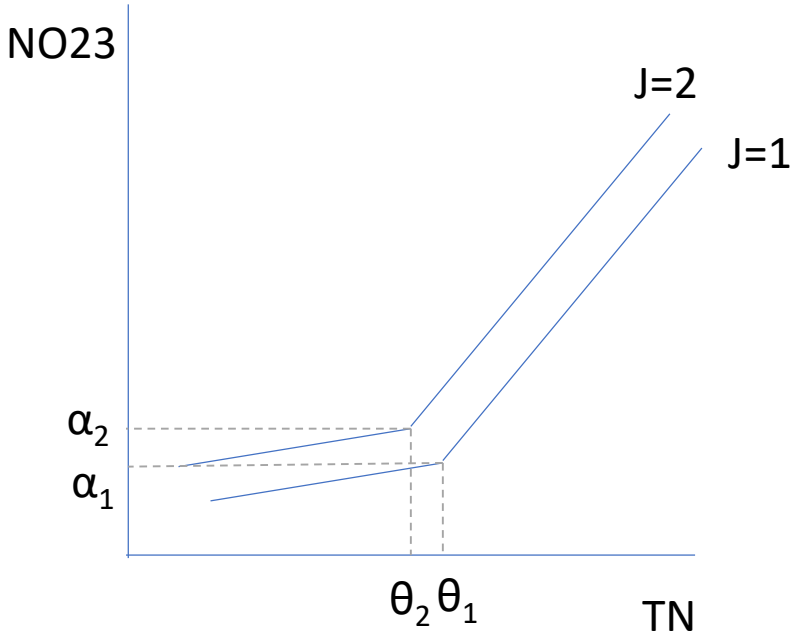
$$NO23_{[i]} = \alpha_{j[i]} + \beta_{j[i],k[i]} * (TN_{[i]} - \theta_{j[i]})$$

i: individual WRTDS stations

j: hydrogeomorphic regions

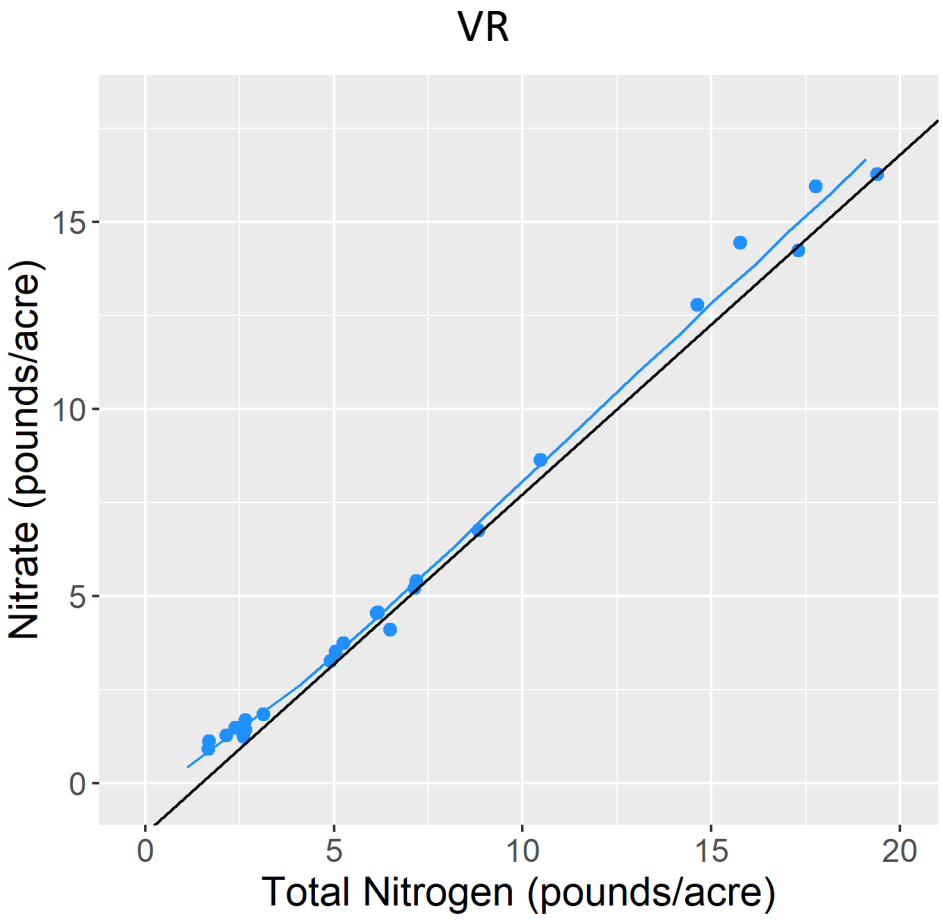
k = 1 if TN < θ

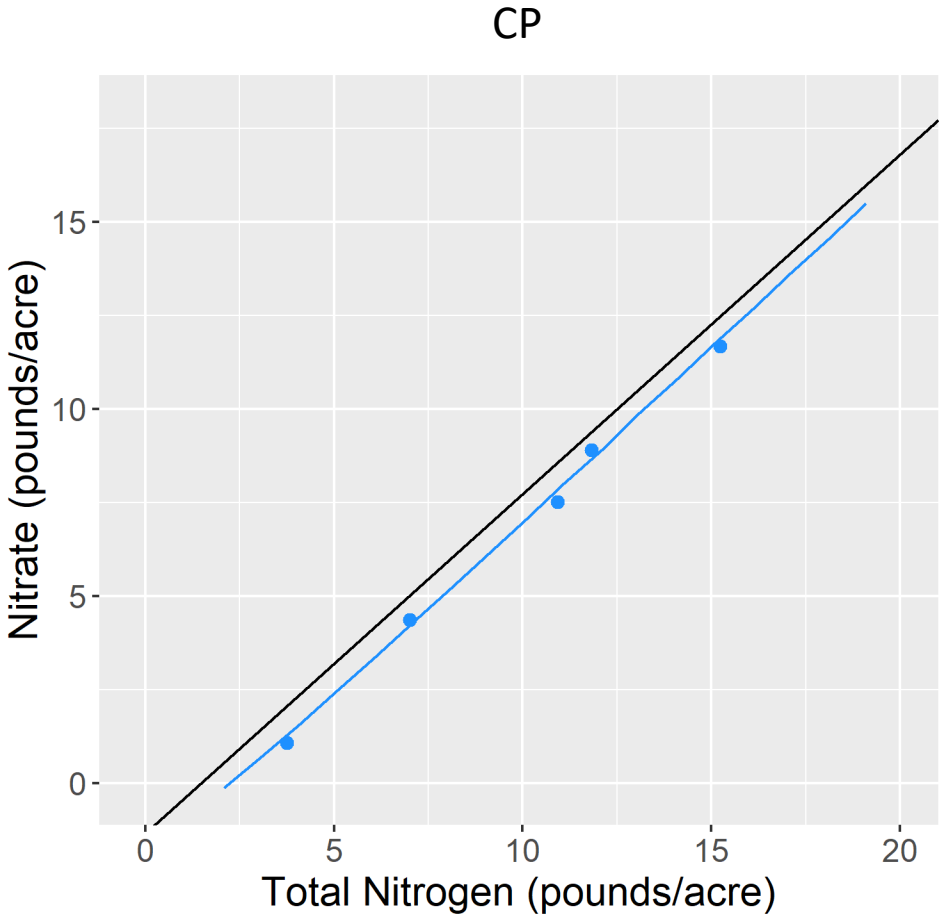
k = 2 if TN > θ



Model results

$$NO23_{[i]} = \alpha_{j[i]} + \beta_{j[i],k[i]} * (TN_{[i]} - \theta_{j[i]})$$





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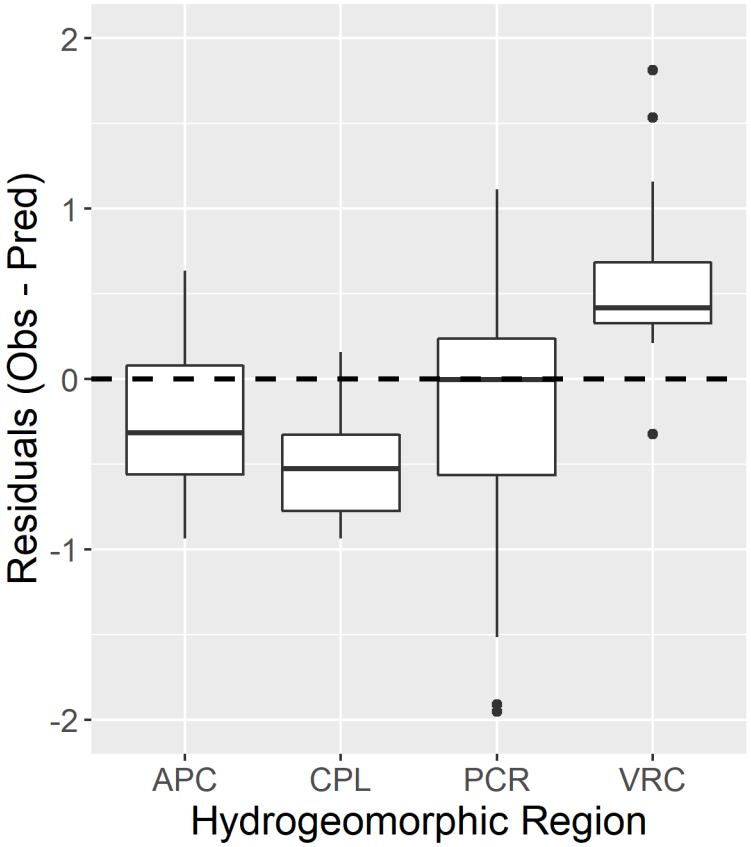
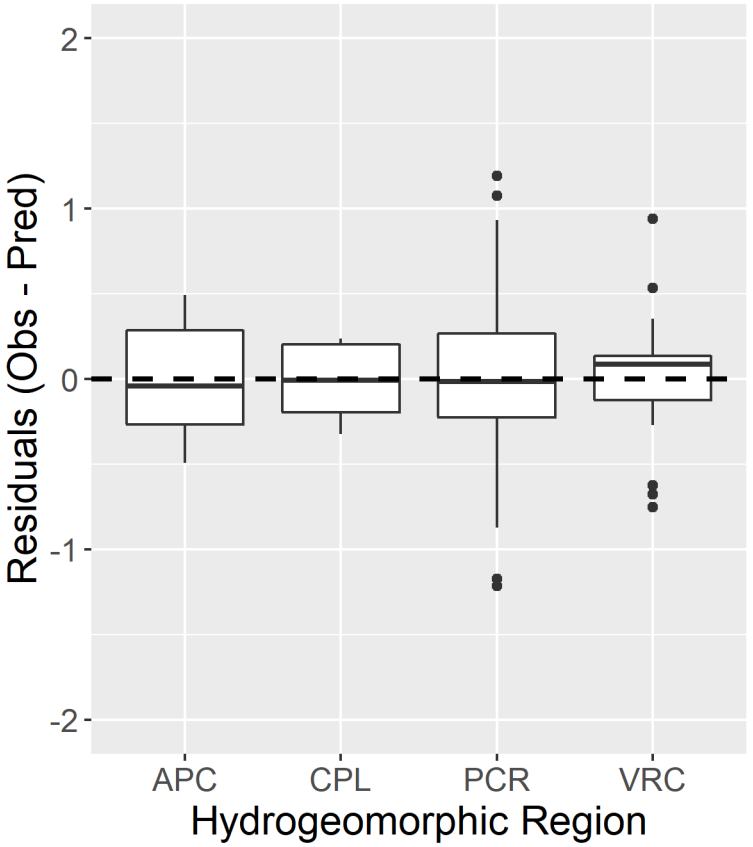
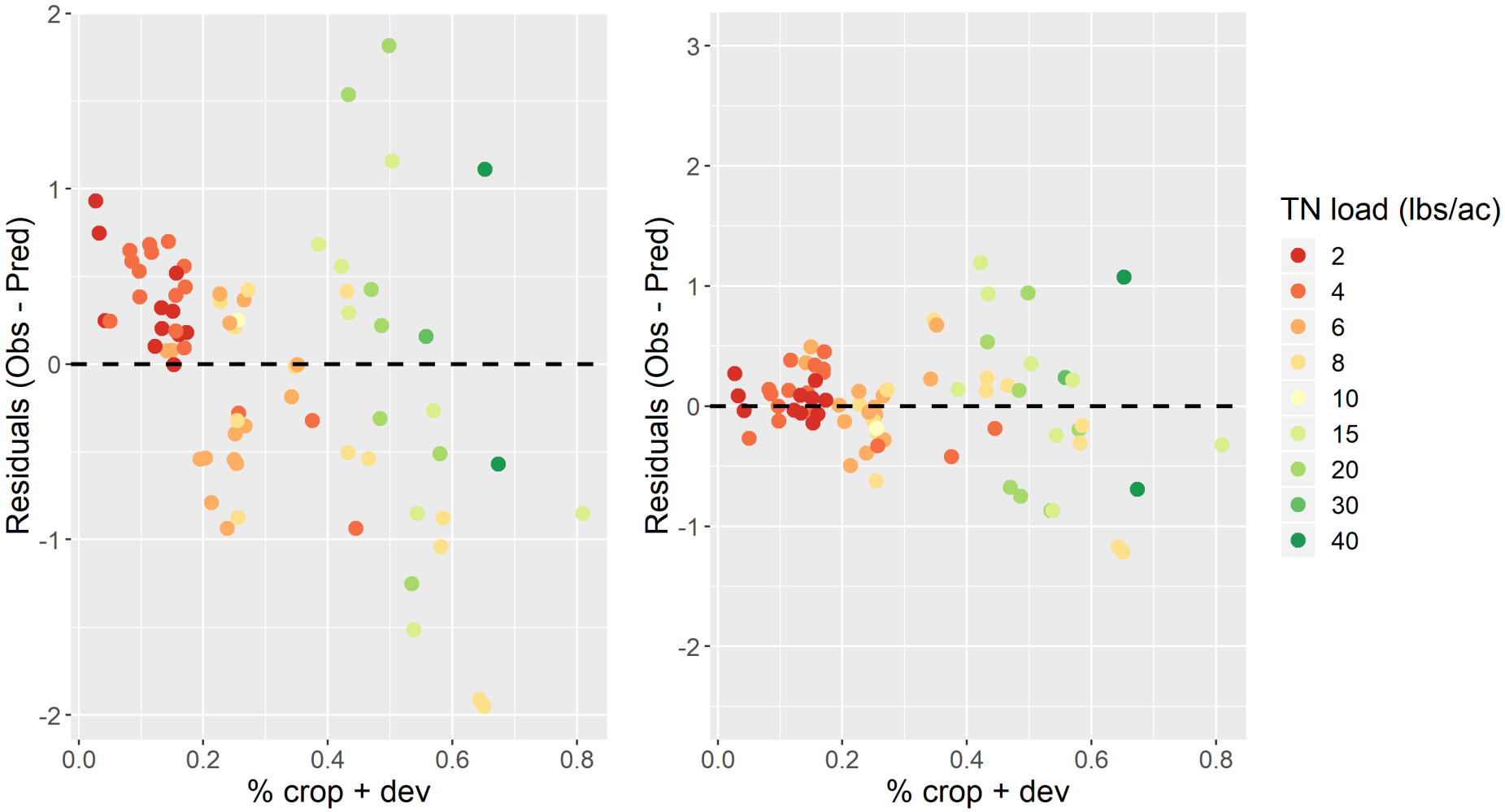
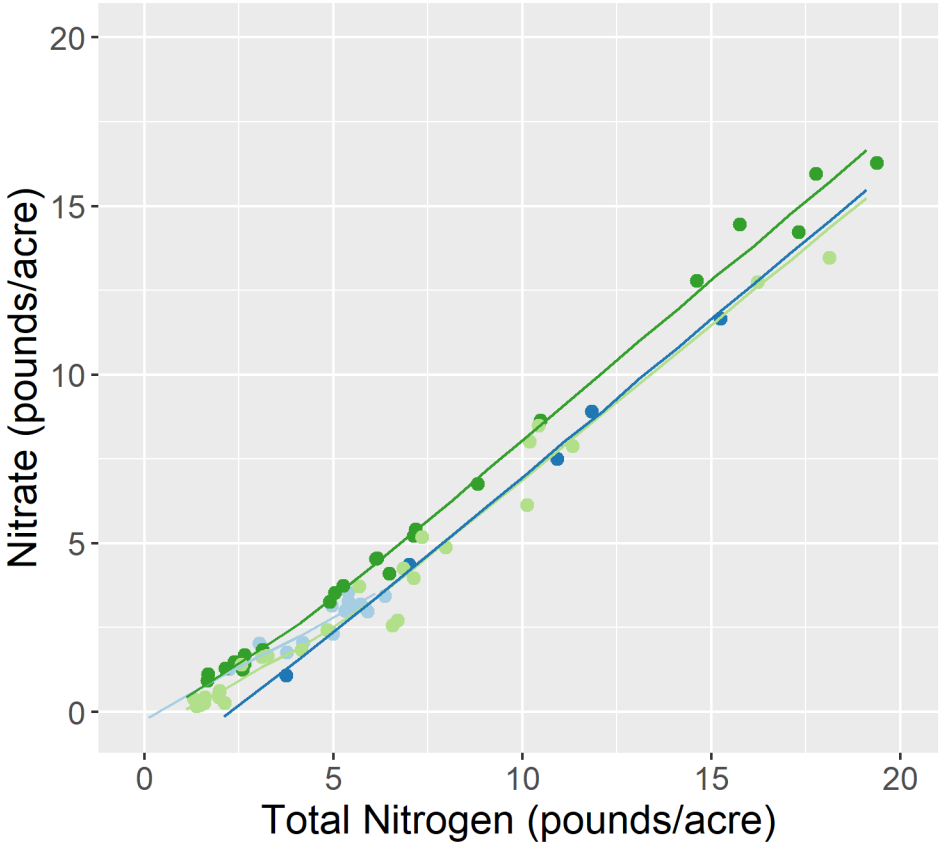




Model results

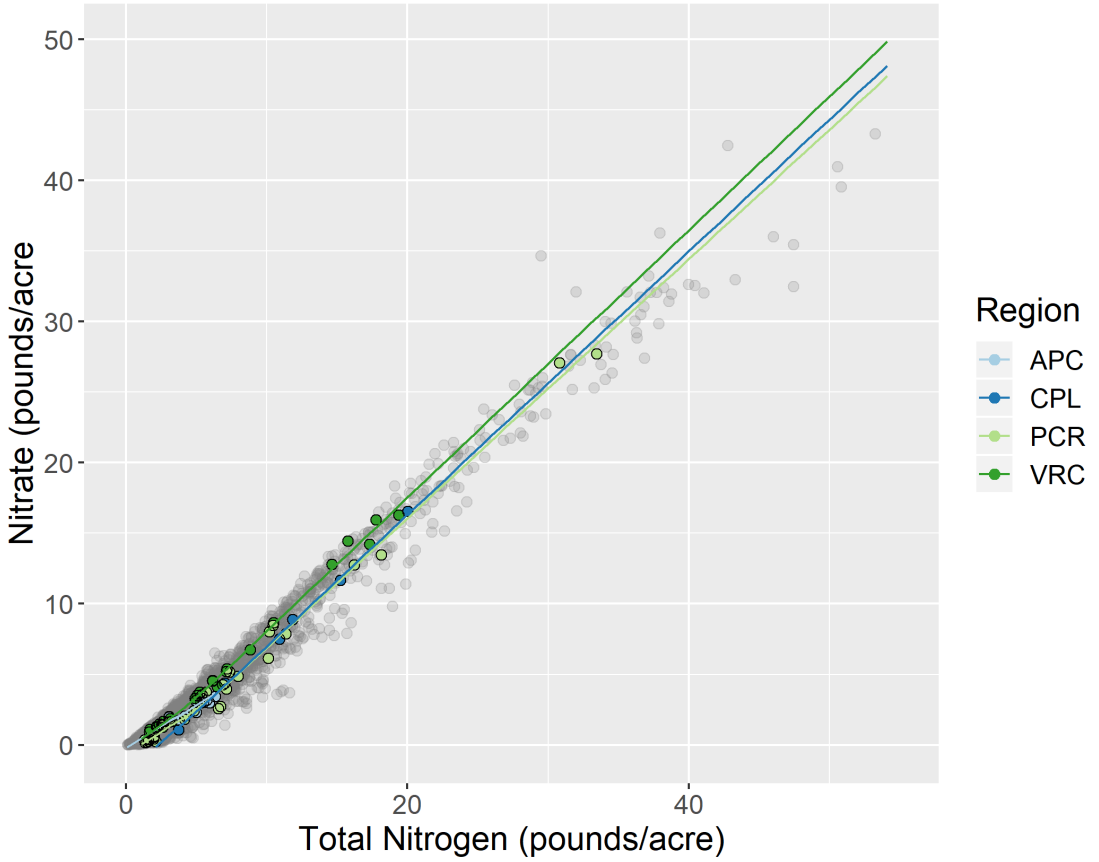


Summary of preliminary analyses



A simple but relatively flexible change-point model improves prediction accuracy and helps explain spatial variation in N speciation across the CB watershed by accounting for changes in response as a function of landscape and land use characteristics

Next steps: Explore variability in hydrology – most relevant to climate change



Can we identify patterns in N speciation in wet vs. dry years that are consistent across sites within similar landscape and land-use properties?

Thank you!