Temporal and Spatial Variability of Groundwater Nitrate in the Southern Willamette Valley, Oregon

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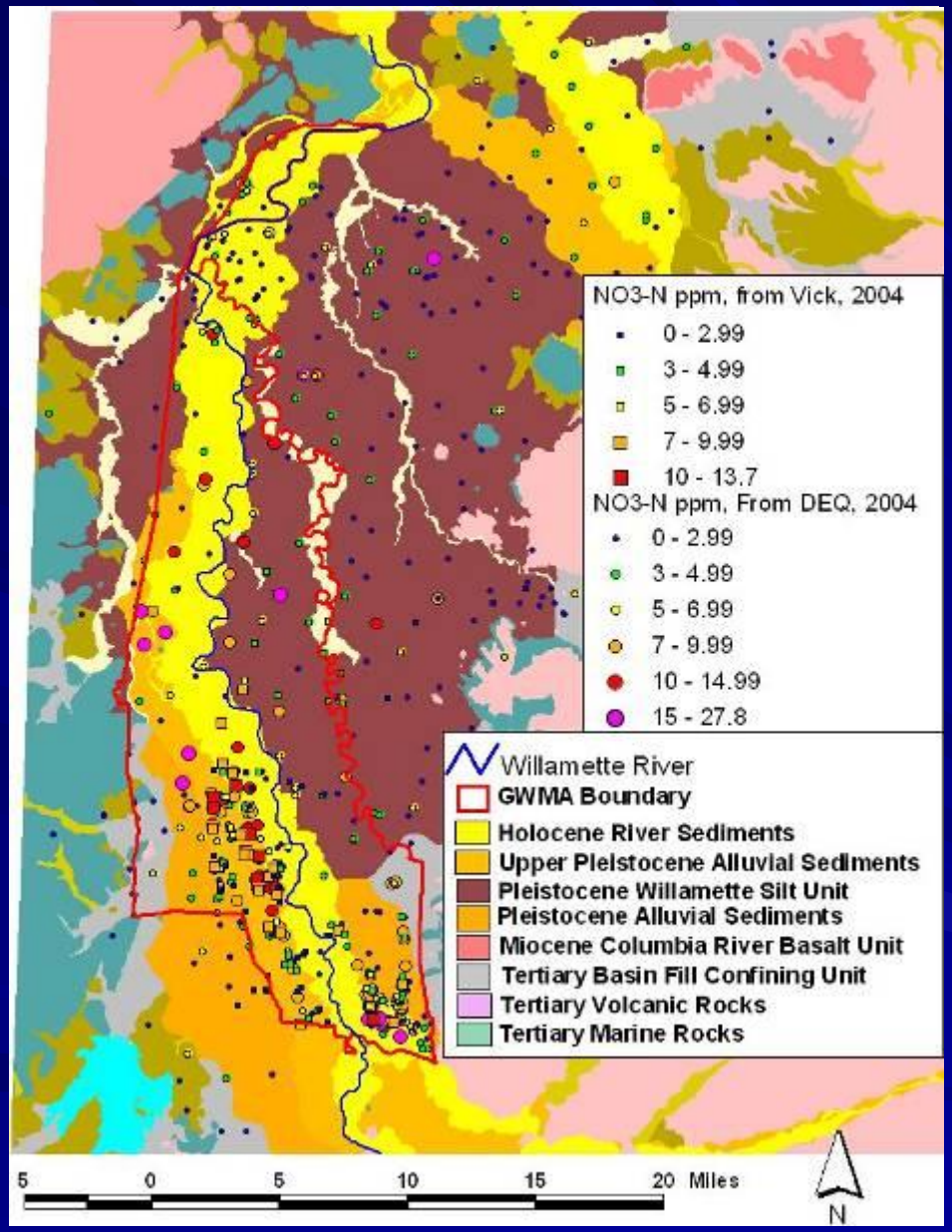
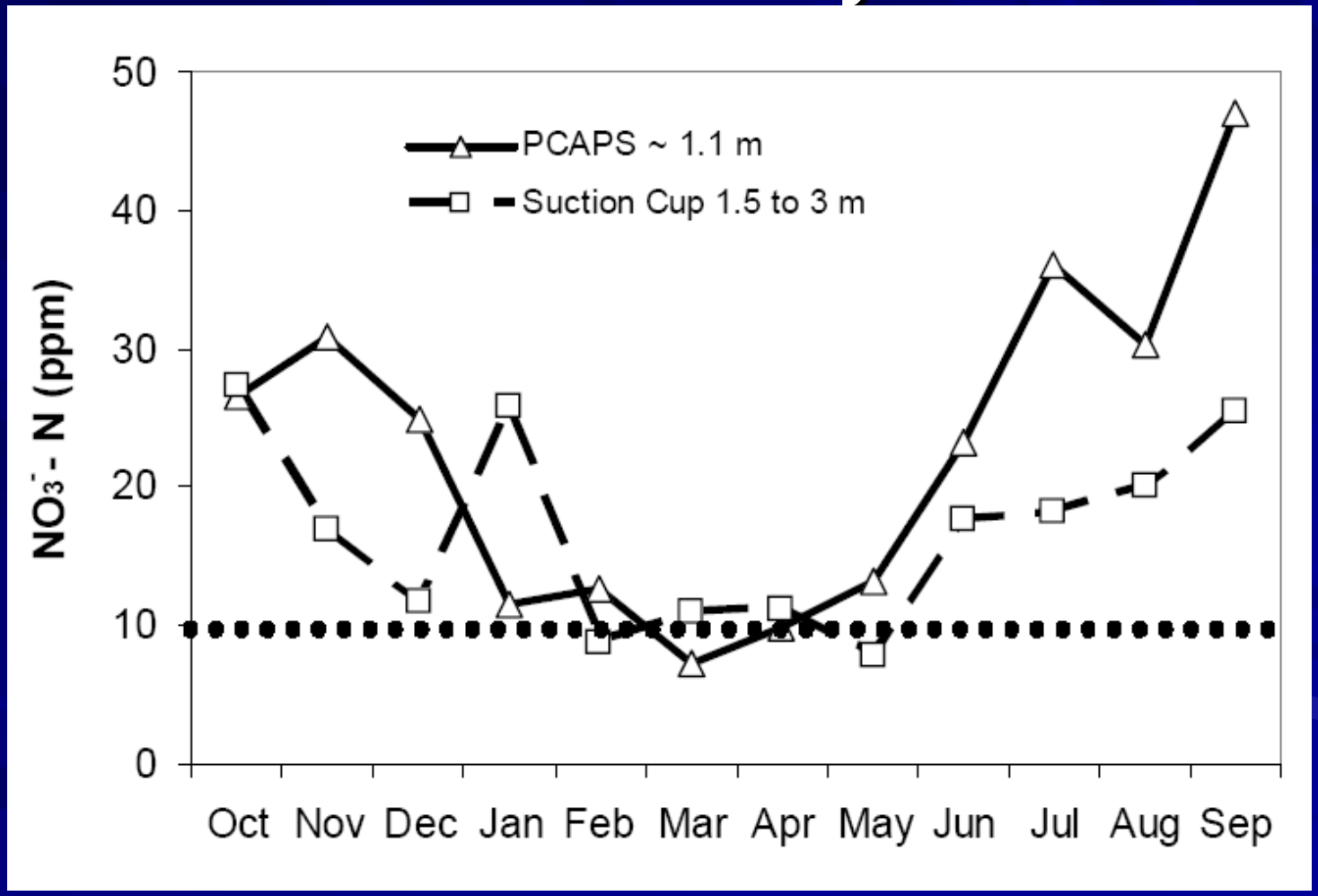
Introduction

- Overview of previous spatial and temporal studies
- Sampling Network
- Results and Implications
- Modeling Nitrogen Dynamics
- Conclusions

Spatial Distribution of Nitrate from Previous Studies



Prior Documentation of Temporal Variability



(From Faega et al., 2004)

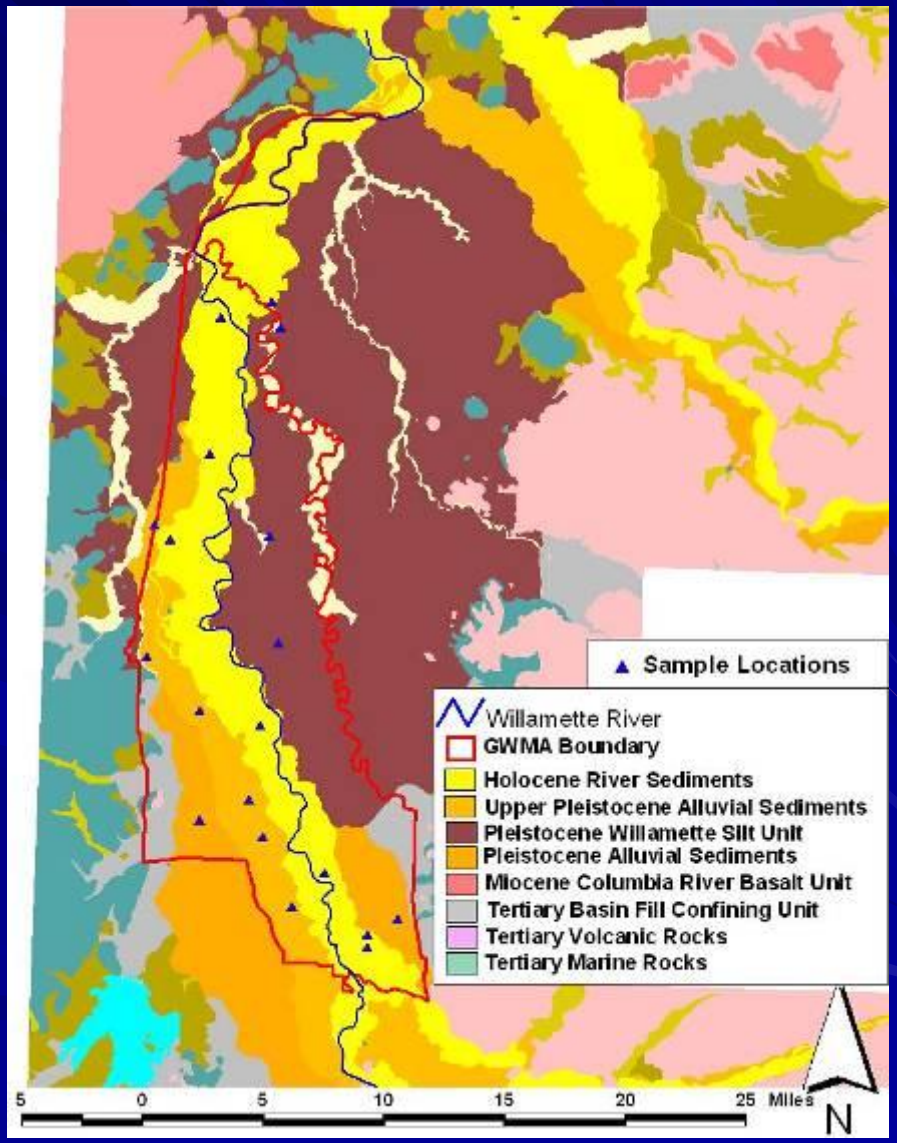
Hypothesis

- Seasonal precipitation should impact shallow groundwater nitrate concentrations

- Why should it matter?
  - Distinguish seasonal trends vs. actual trends in monitoring data
  - Determine optimal sampling periods

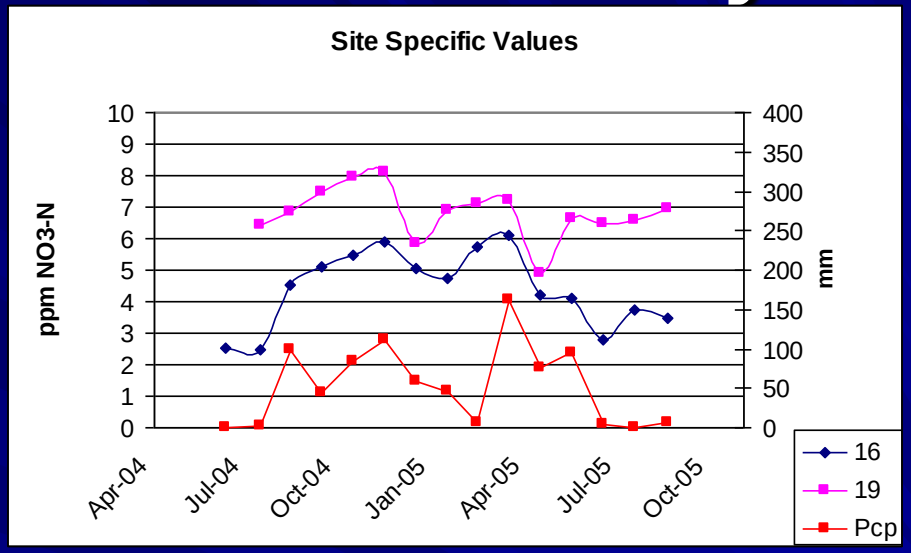
Monitoring Network

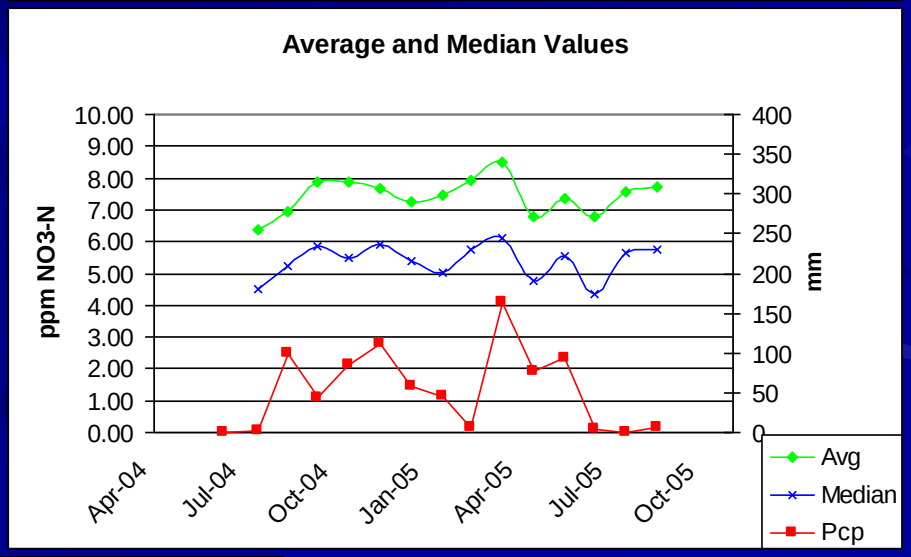
- 19 wells sampled monthly for 15 months
  - 15 residential wells
  - 4 monitoring wells
- Well log extant
- Well Depth ≤ 50 ft
- Screening Interval ≤ 15 ft
- Pass Coliform bacteria test



Was there Seasonal Variability?

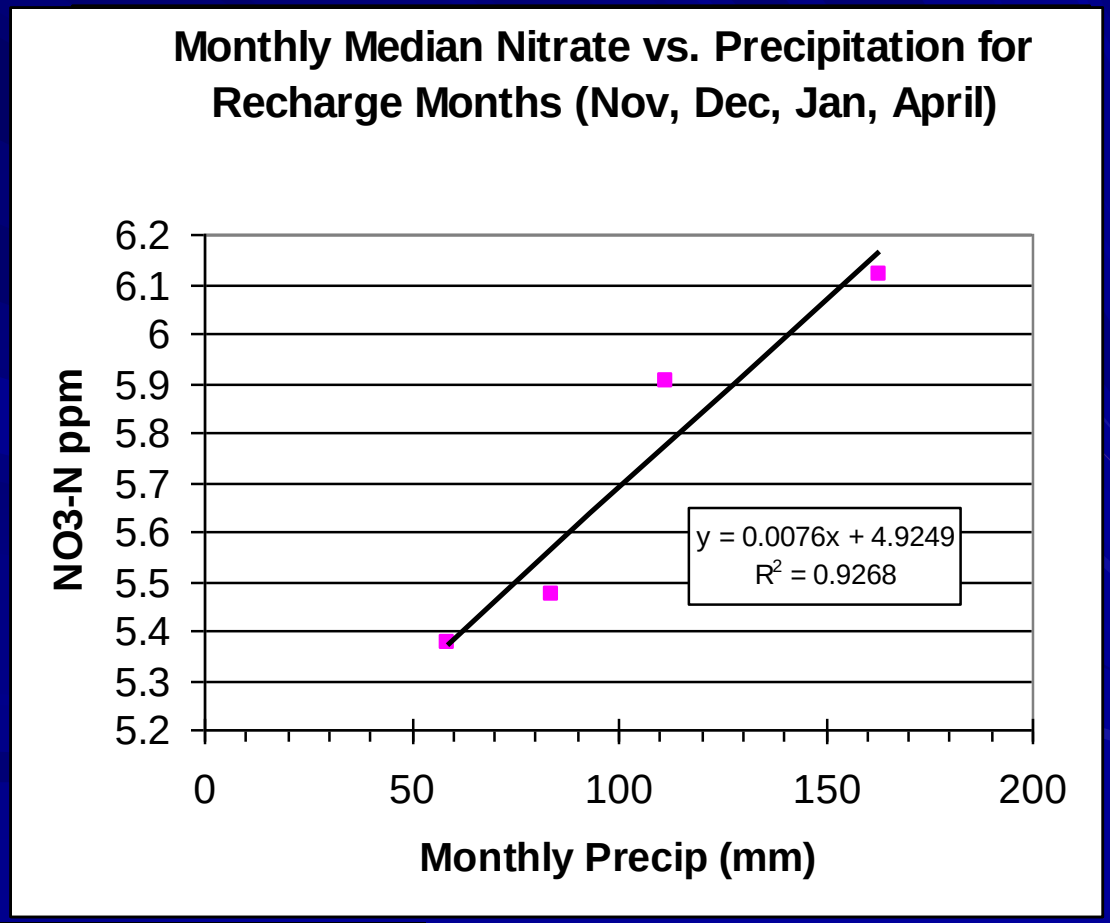
- Yes, precipitation influences nitrate values
- However, seasonal wetting patterns are critical!



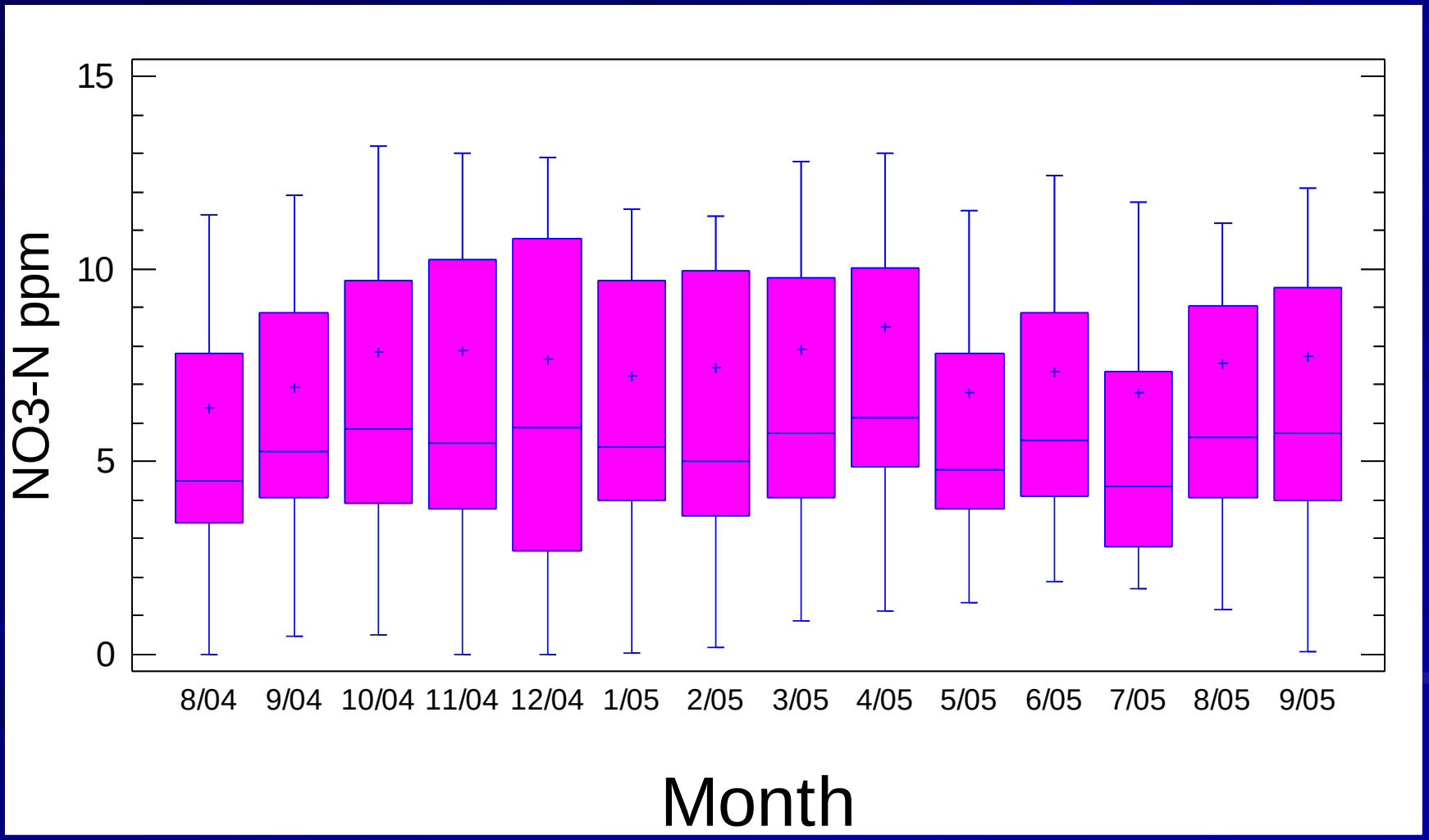


Wetting Up Period Necessary to have NO_3^- Response

- Used water levels to indicate when recharge occurred
- Soil needs to wet up before recharge, then groundwater nitrate values respond to precipitation

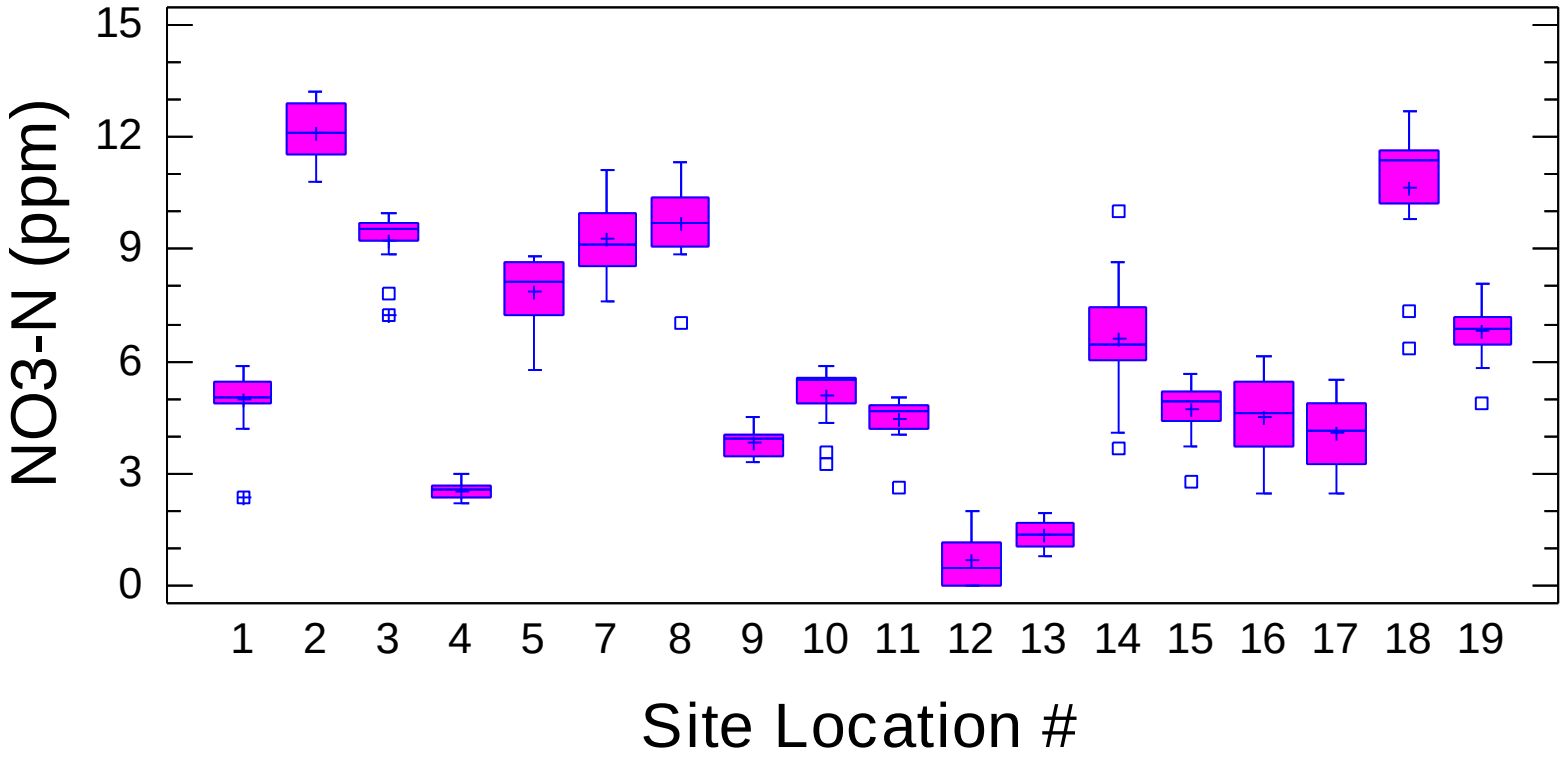


When might policy managers want to sample?

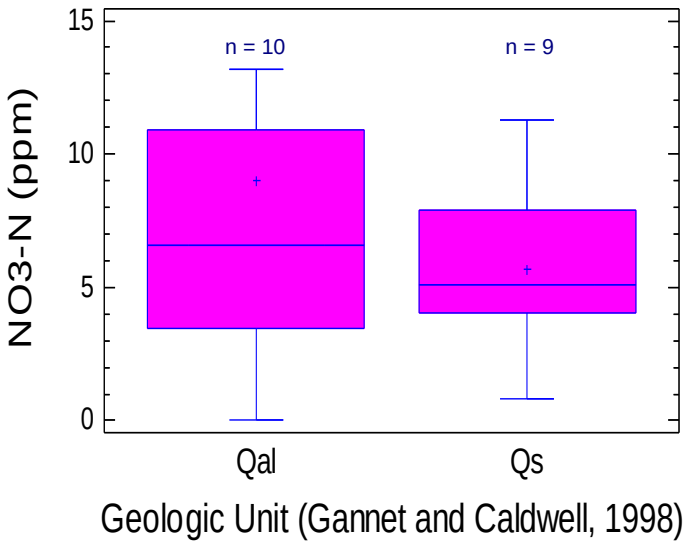


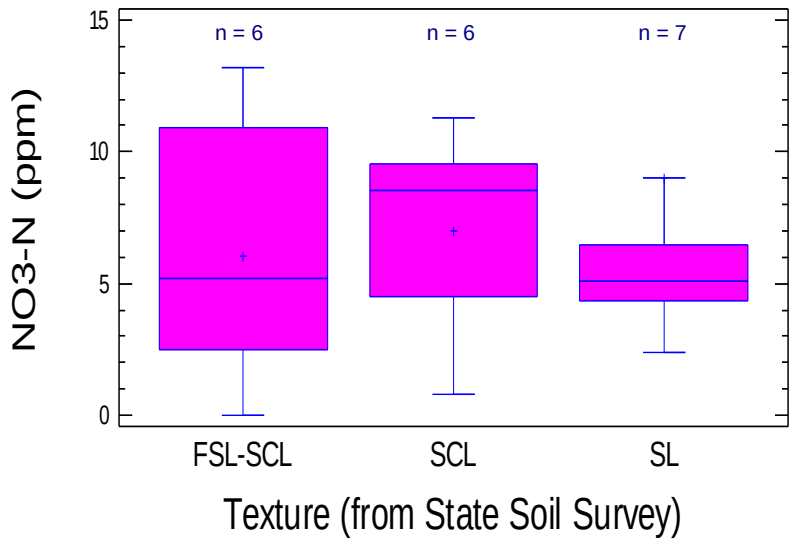
Can we relate temporal variability to spatial variability?

Spatial variability is much greater than temporal!!



Sample Distributions Based on Geology and Soil





- Qal = Holocene Floodplain and Alluvial Deposits
- Qs = Pleistocene Alluvium and Flood Deposits
- FSL= Fine Sandy Loam
- SCL= Silty Clay Loam
- SL= Silt Loam

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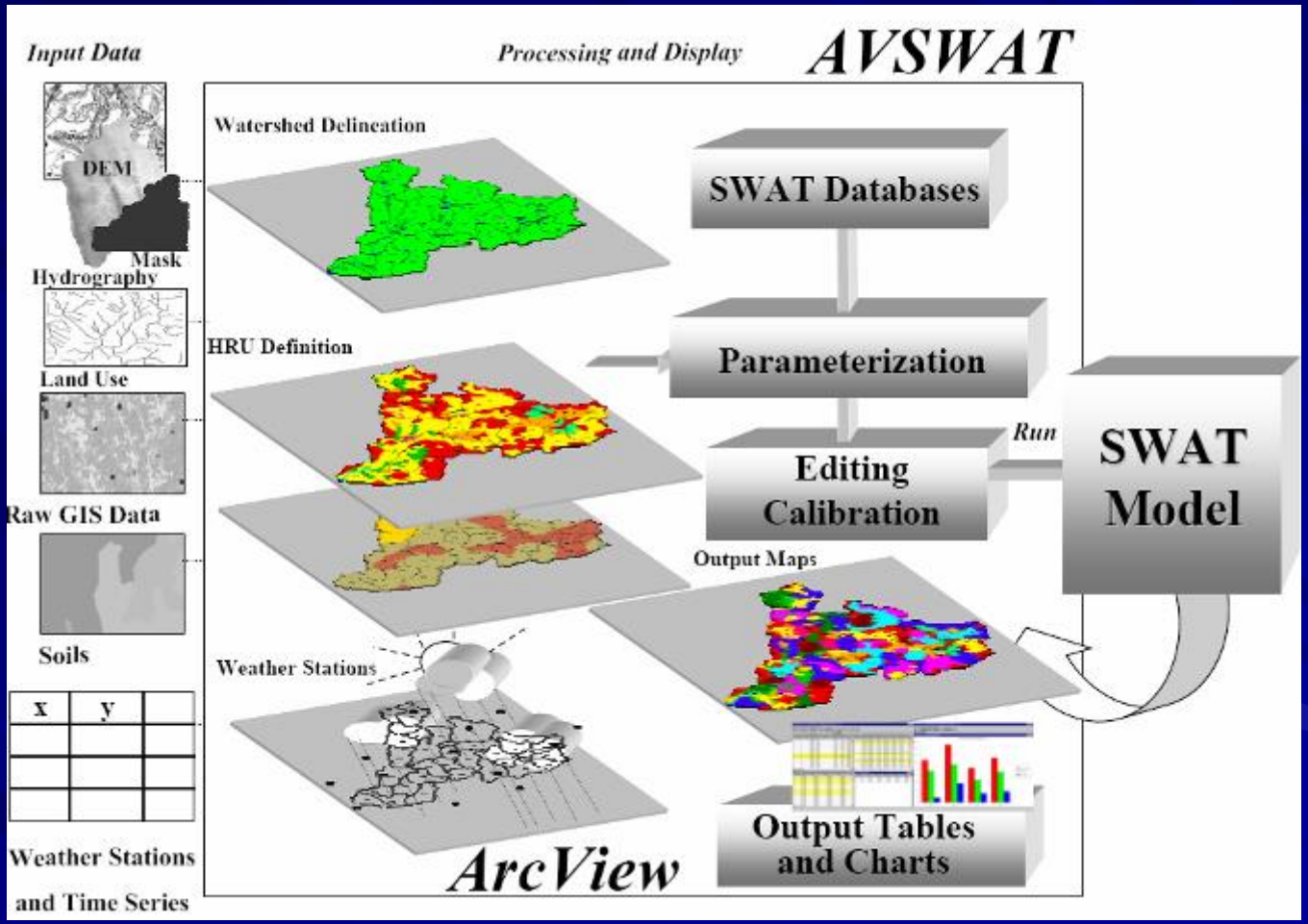
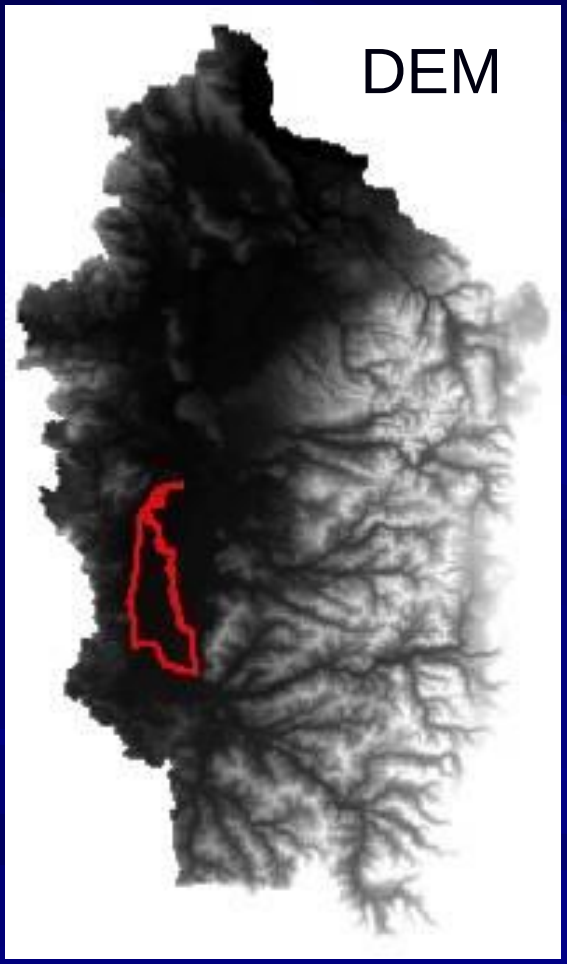
Part II: What if we can model these Variabilities?

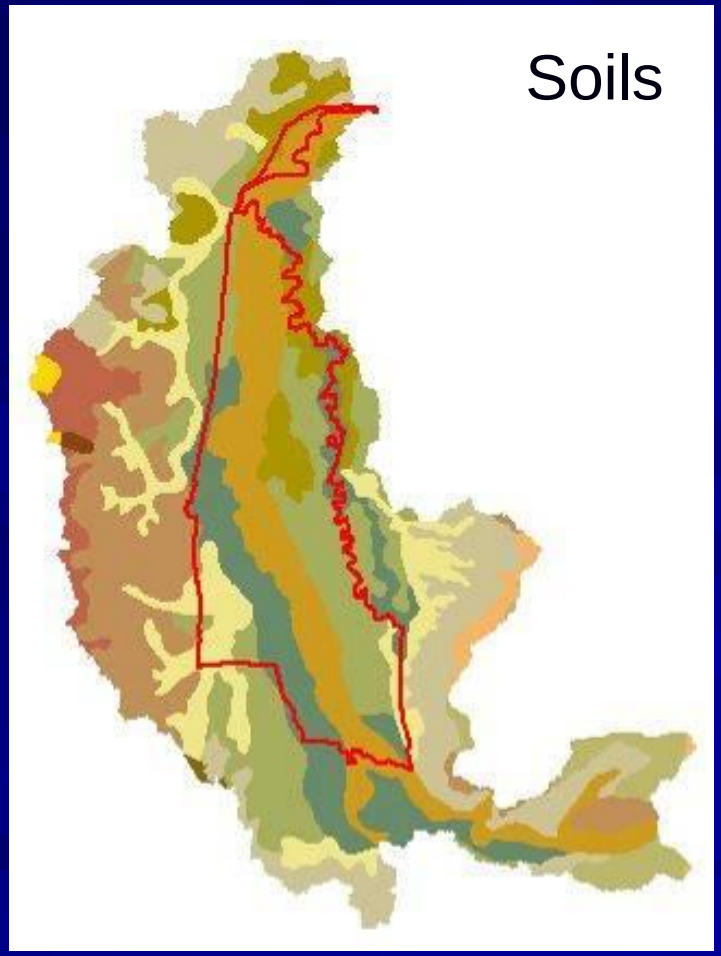


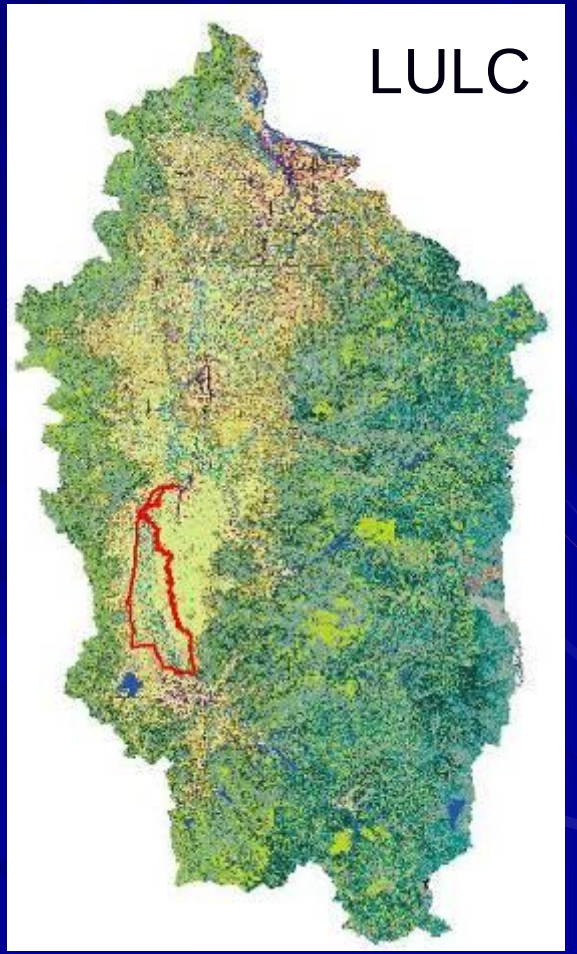
Modeling Goals

- Calibrate SWAT so that reasonable outputs are obtained and validated
- Examine different land management options and their impact on leached nitrate
- Examine future scenarios and the impacts of nitrate Best Management Practices

SWAT GIS Inputs

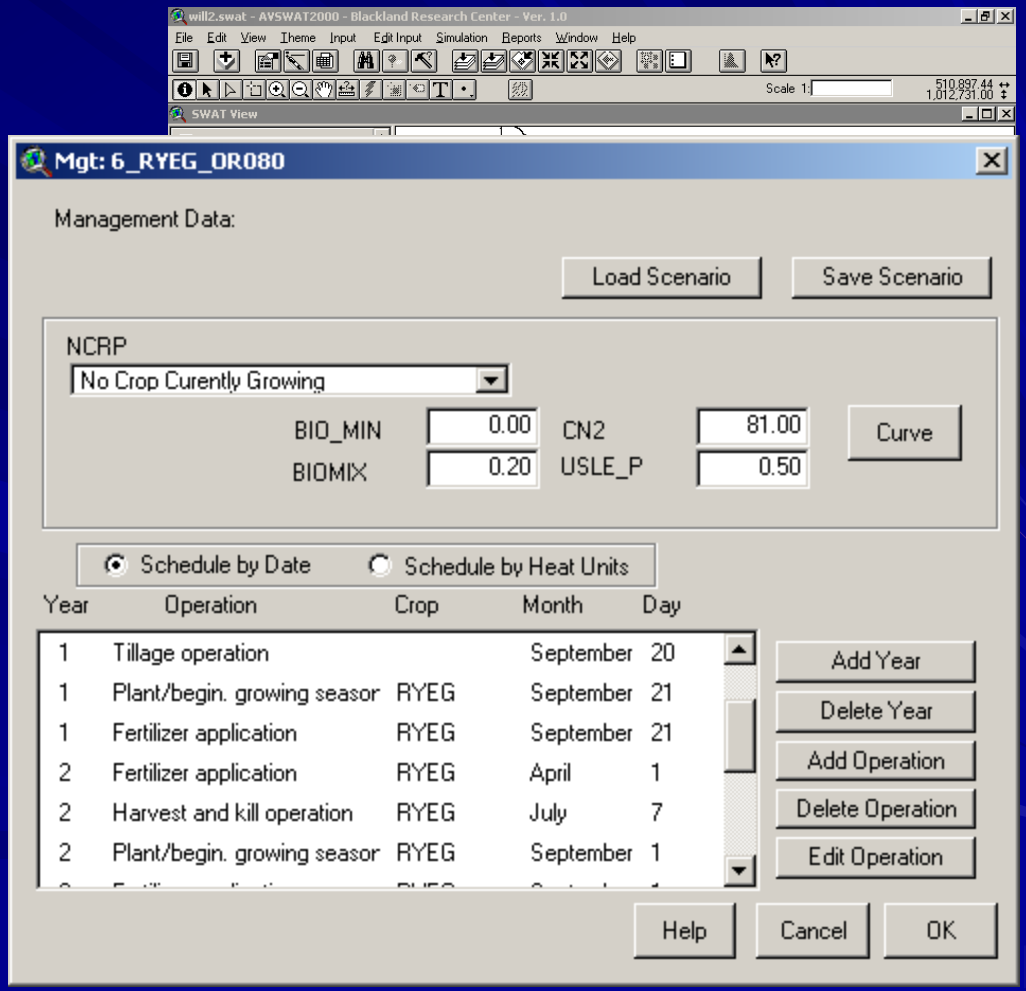




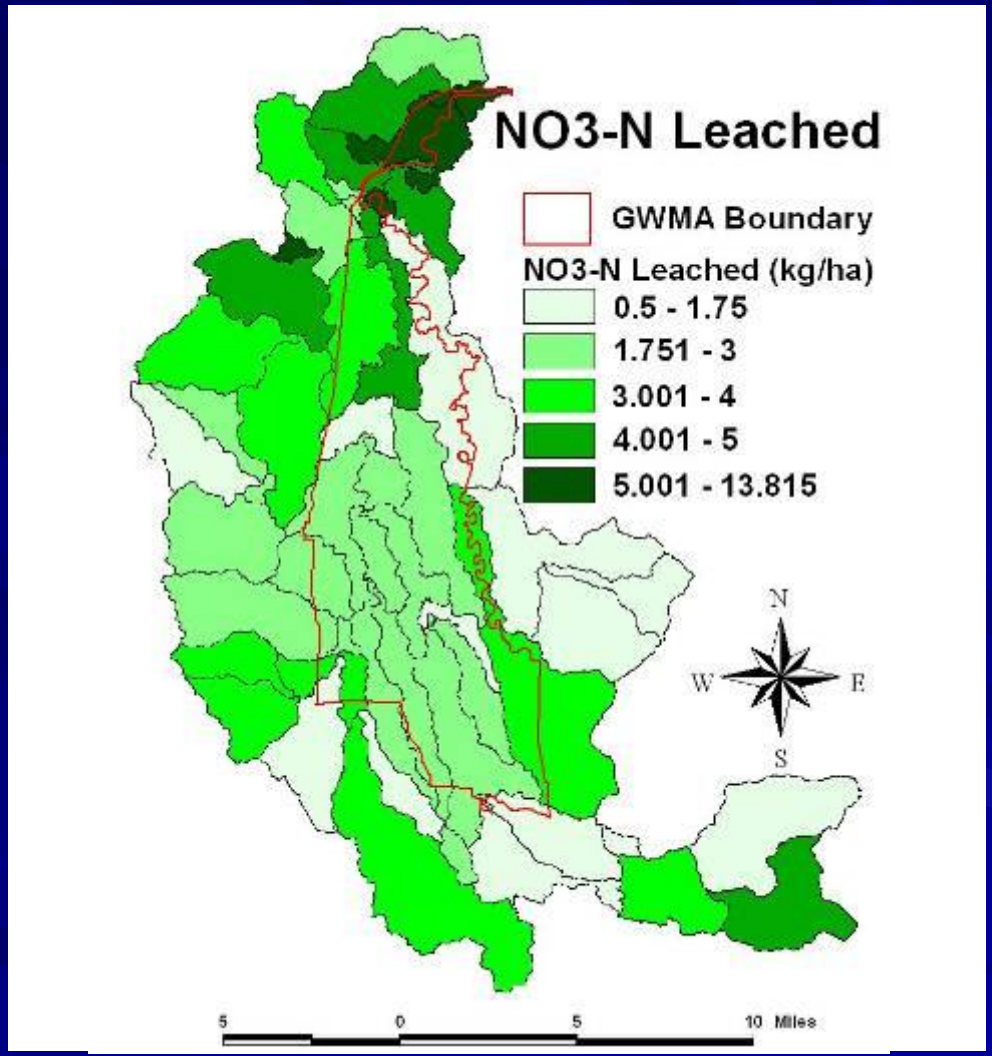


Non-GIS Model Inputs

- Climate Data
- River flows originating from non-modeled areas
- Land Management Practices



Modeled Area & Pre-Calibration Results



Closing Points

- Relationship between NO_3^- and precipitation may be biased by data set: needs further analysis
- Data uncertainties have yet to be analyzed
- Small sample size could limit the significance of results

Conclusions

- Nitrate concentrations in the Southern Willamette Valley are dynamically linked to precipitation during recharge months
- The recharge month with the highest annual precipitation is likely to have the highest annual groundwater NO_3^- concentration (but also the highest variability!!)
- Wells drilled in different geologic formations or soil classes are likely to exhibit different seasonal variabilities

Acknowledgements:

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