Relative Influence of Watershed and Reach-scale Land Cover on Stream Trophic State

Jeremy Alberts
Department of Biological Sciences
University of Cincinnati
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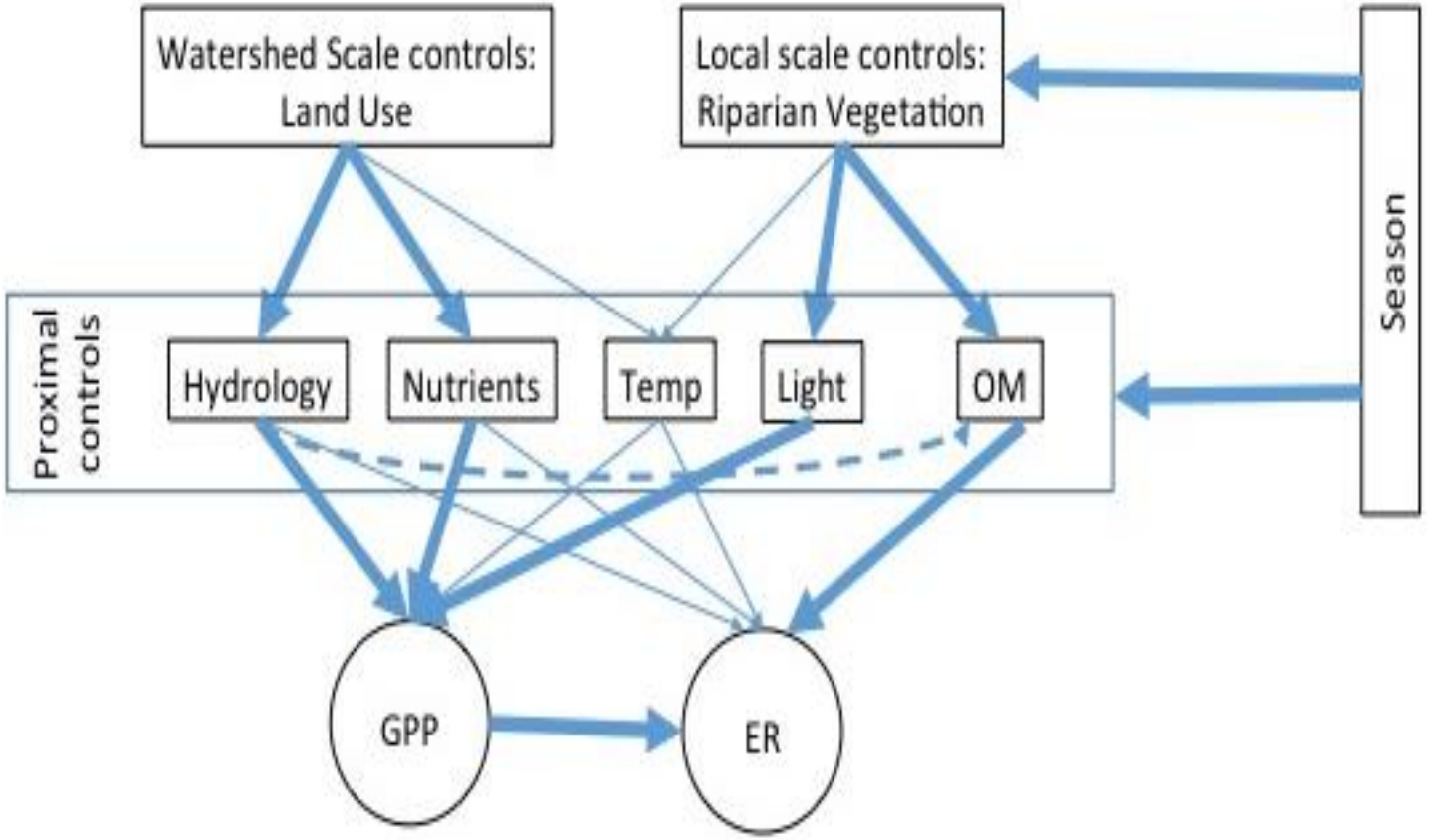
What is “Trophic State”?

- Net Heterotrophy (P < R)
  - Food web fueled by terrestrial organic matter
  - System respires more energy than is made available via photosynthesis
- Net Autotrophy (P > R)
  - Primary production in excess of needs for respiration
  - Potential for accumulation of algal biomass

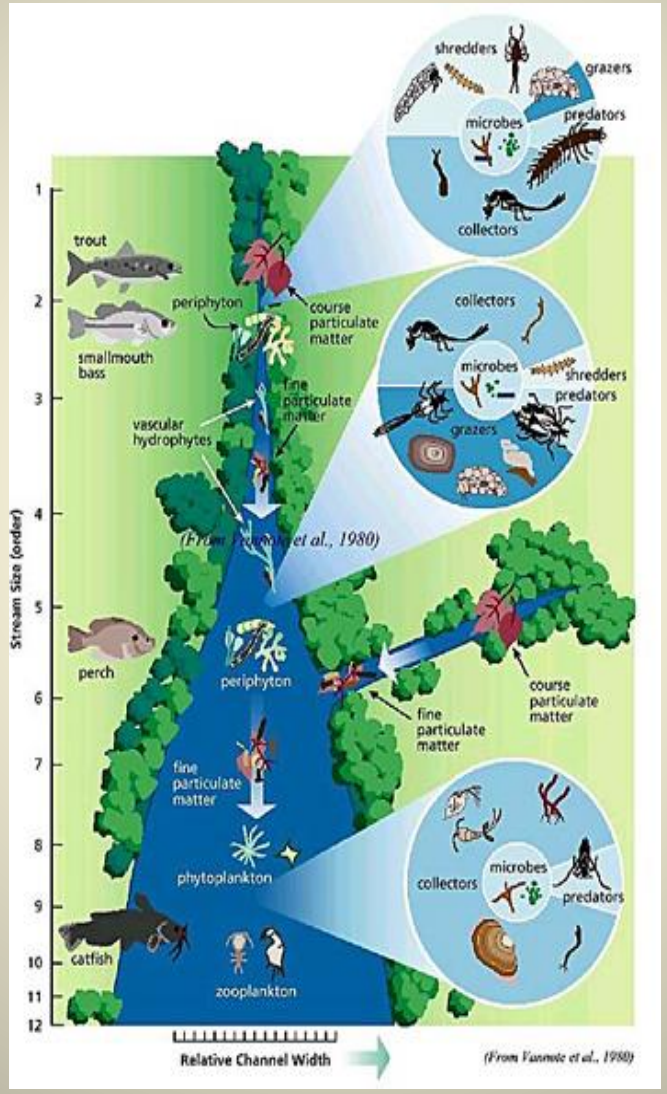
Dodds (2006) *Limnol. Oceanogr.,* 51, 671–680

Regional template: climate, vegetation, topography



NEP = GPP - ER

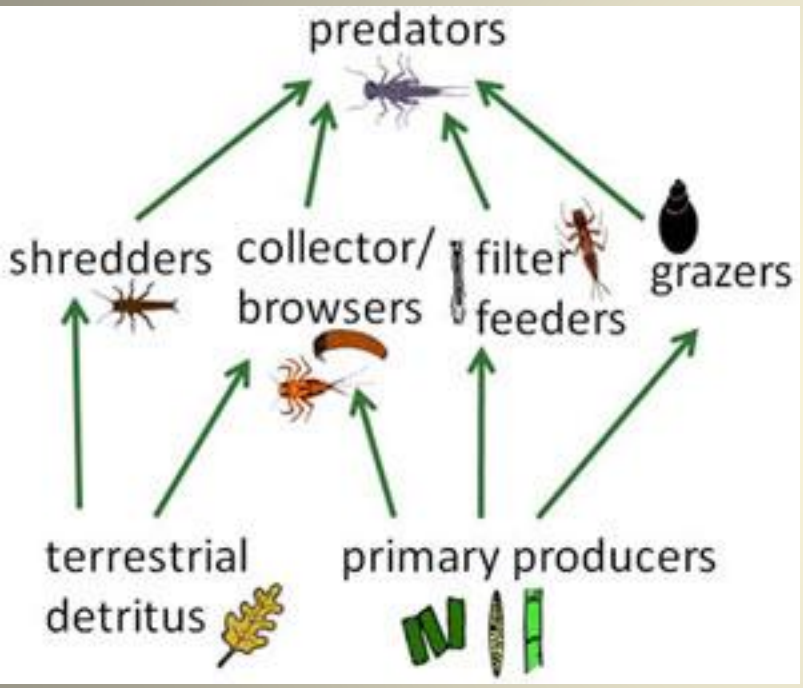
What do we expect?

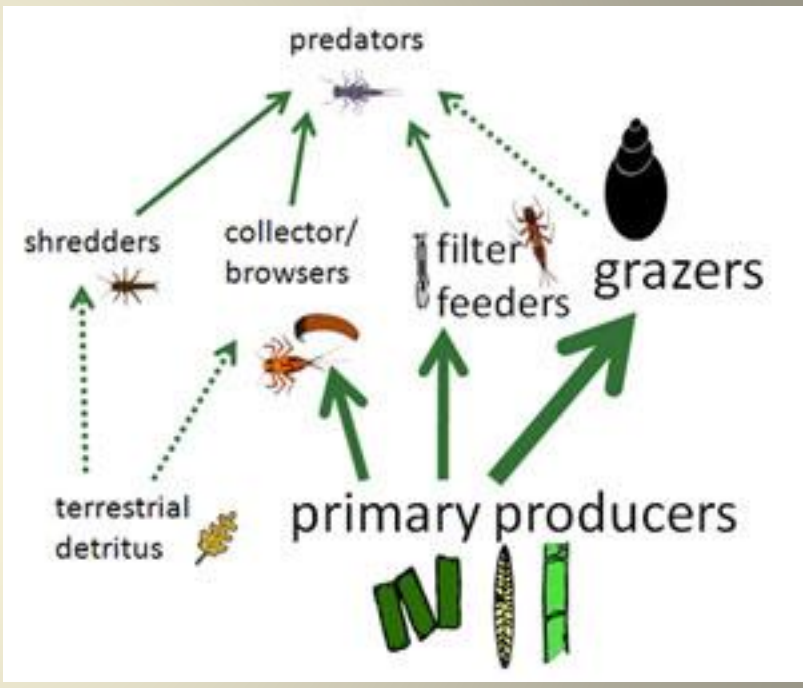


Why does it matter?

- Accumulation of algal biomass can result in:
  - Low O_2 at night
  - Clog drinking water intakes
  - Affect stream flow
  - Alteration of stream habitat

Impacts on stream community?





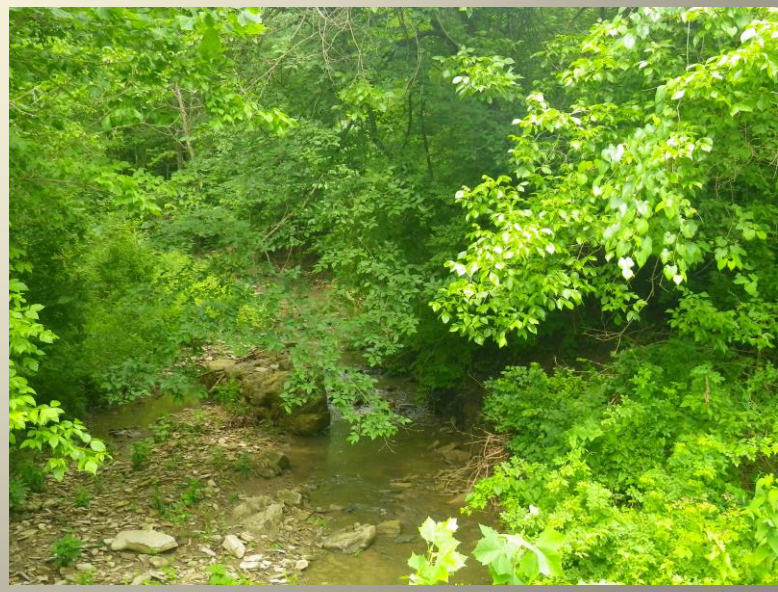
Freshwater Ecology Research Group
University of Canterbury
http://www.biol.canterbury.ac.nz/ferg/riparian_foodwebs.shtml

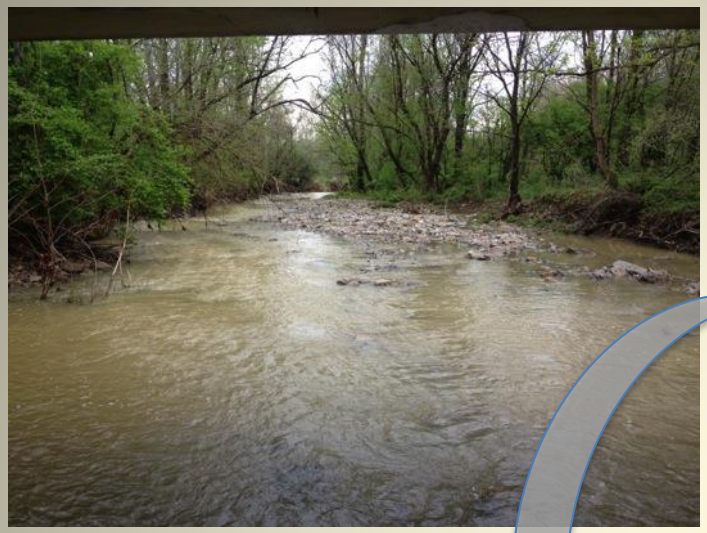
Project Objectives

- Investigate how trophic state is controlled by land cover at multiple scales
- Evaluate potential impacts on secondary production
- Better understand limiting mechanisms in urban and reference streams

Study Design

- 4 Reference (Forested) and 4 Urban Streams
- Paired Shaded and Sunlit Reaches (n = 16)
- Seasonal estimates of GPP, ER, and NEP for each reach (n = 64)

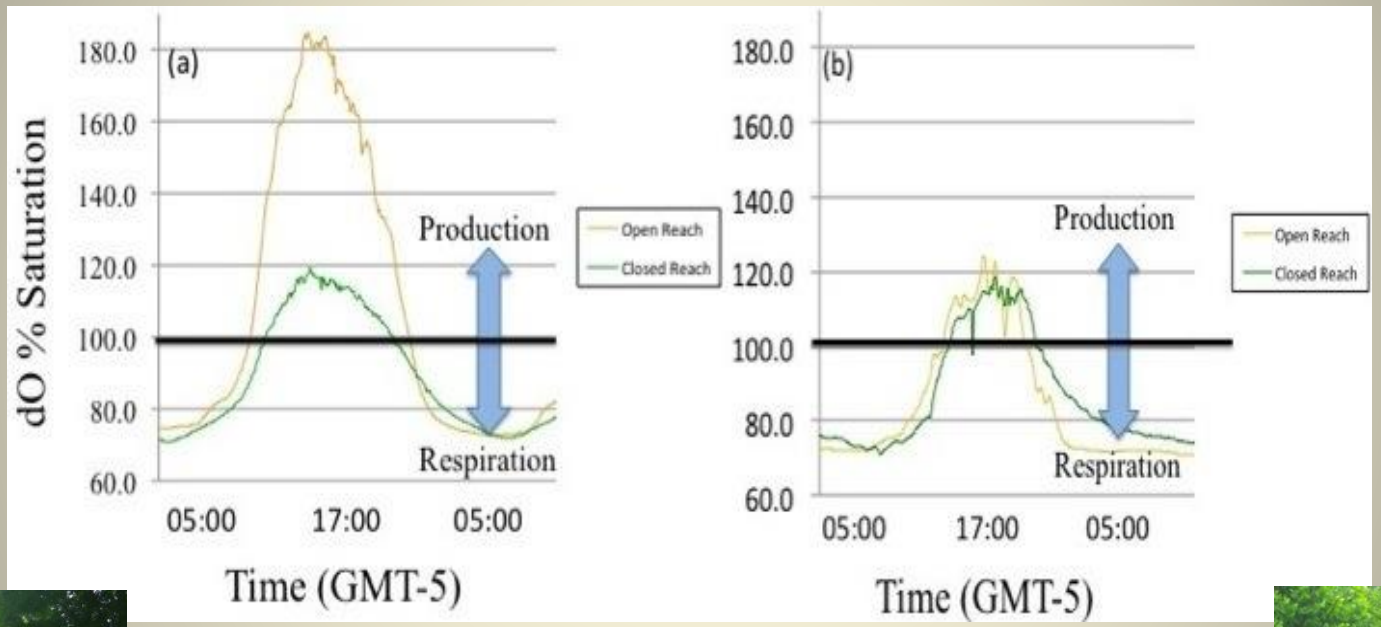




Hypotheses

1. Sunlit reaches will have higher GPP
   - More sun = higher GPP
2. Urban streams will have higher GPP
   - More nutrients = higher GPP
3. ER will be determined by seasonal patterns in organic matter
   - Example: leaf litter inputs in fall, periphyton accrual in spring
4. NEP will be affected by spatial and temporal factors

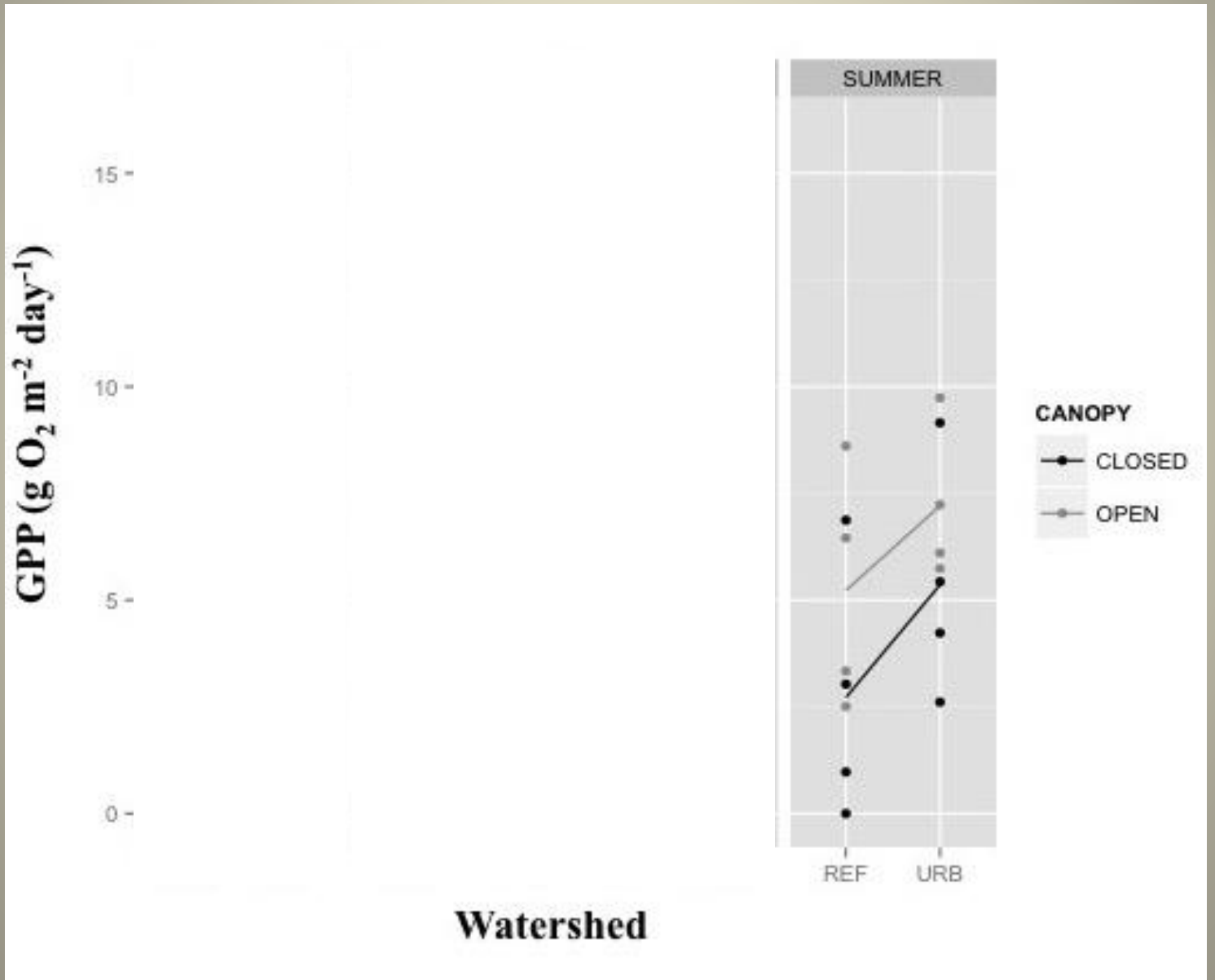
Diel Dissolved Oxygen



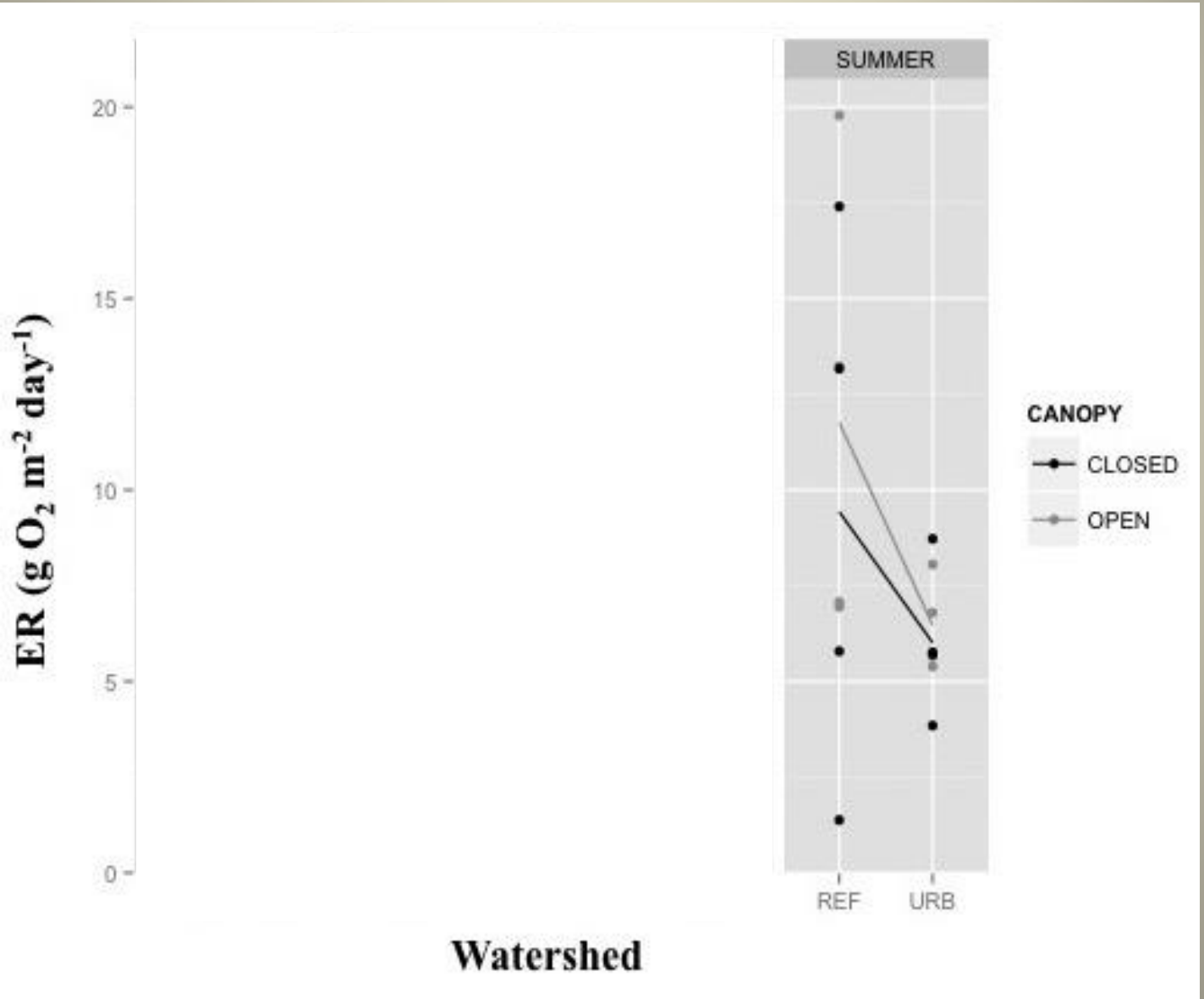
URBAN REFERENCE

Summer 2013

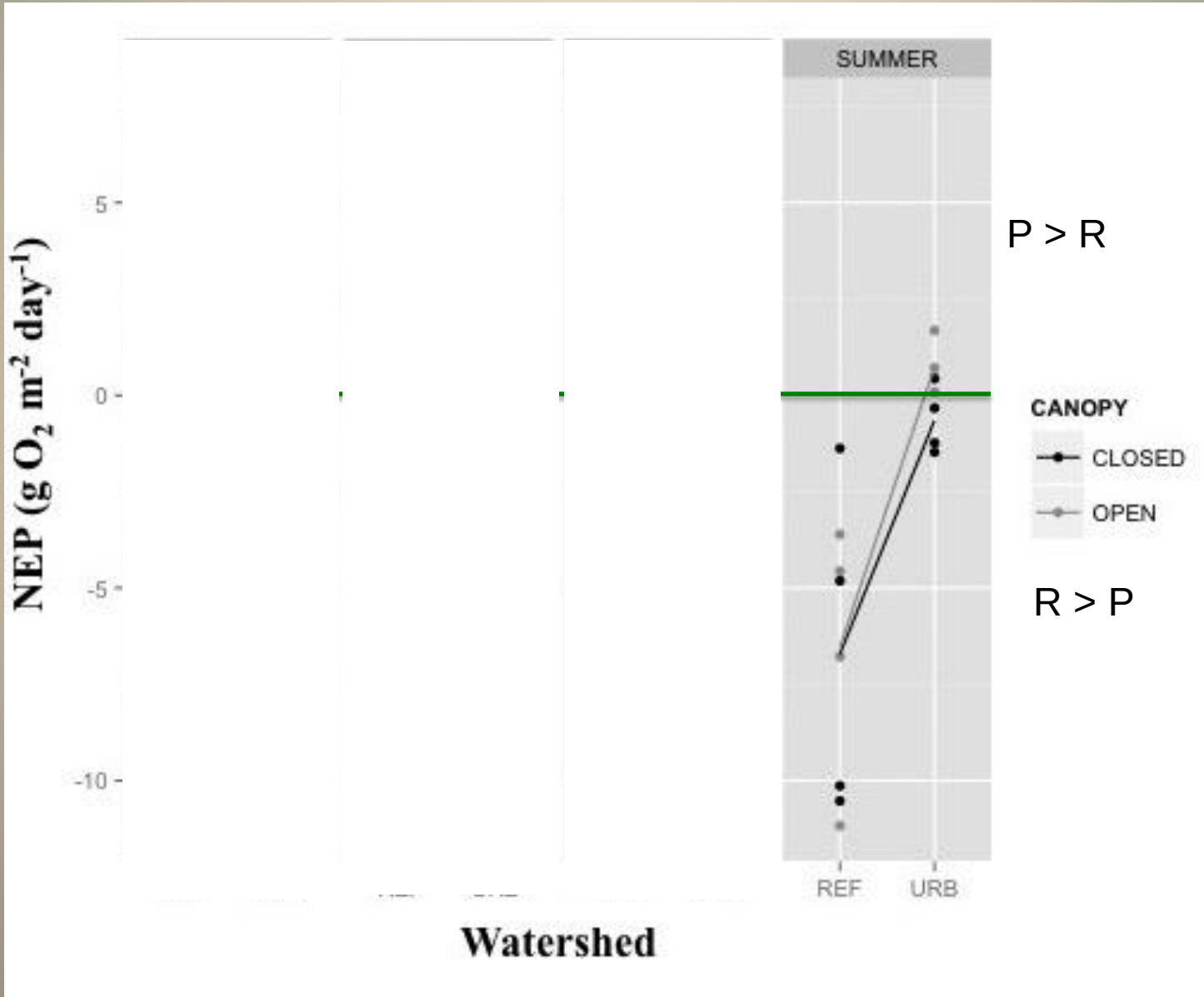
Gross Primary Production



Ecosystem Respiration



Net Ecosystem Production



Conclusions

- Though canopy effect is evident, watershed urbanization leads to elevated GPP regardless of canopy
- ER varies by season and watershed land-use
- NEP is affected by a combination of seasonal and spatial factors
- Canopy cover may be useful in regulating overall trophic state in urban streams

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