

***Sediment and epilithon metabolism and hydrolytic activity in streams affected by mountaintop removal coal mining, West Virginia, U.S.A.***

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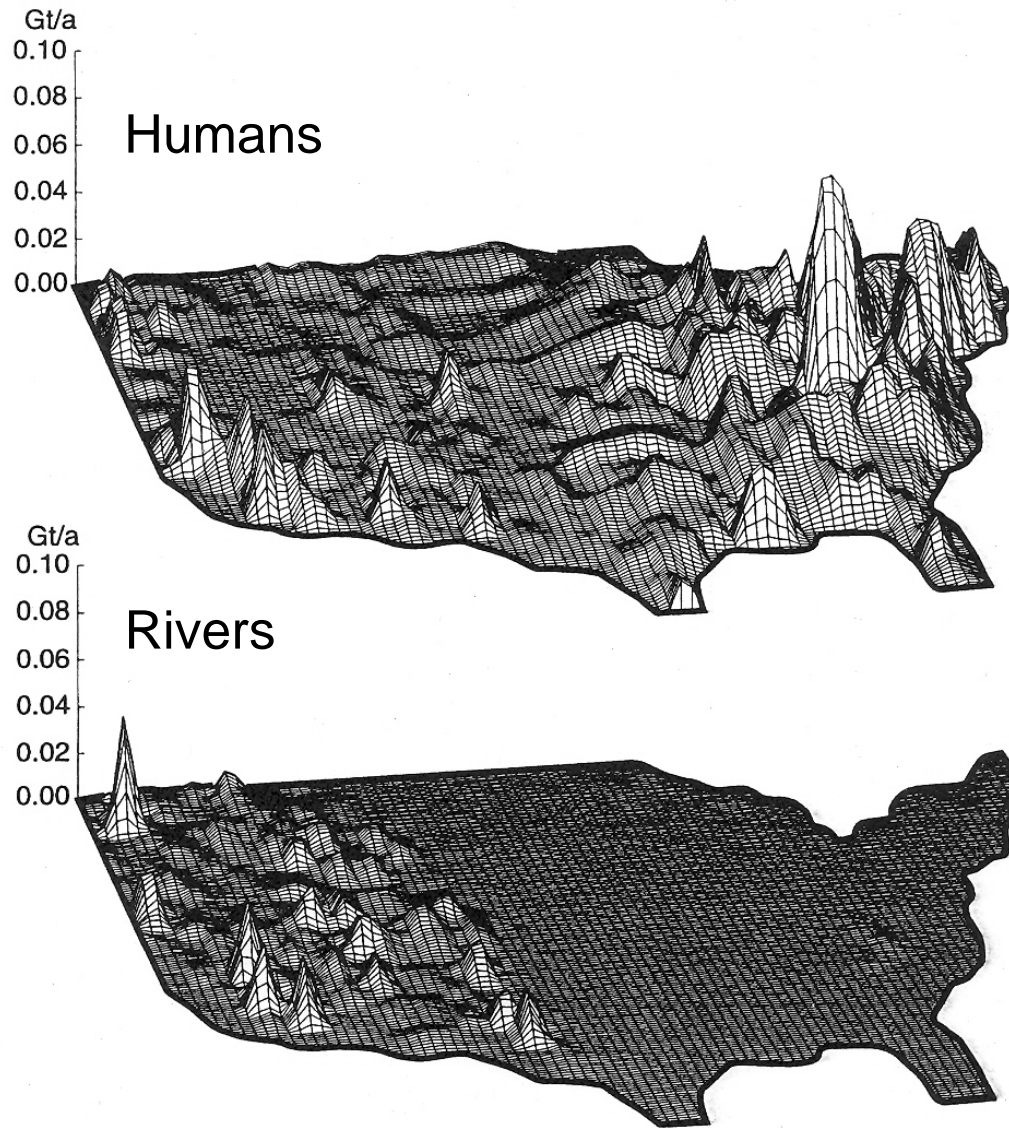
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# Spatial distribution of earth moved by humans vs. rivers



From Hooke 1999

Figure 1. Maps of the United States showing, by variations in peak height, the rates at which earth is moved in gigatonnes per annum in a grid cell measuring 1° (latitude and longitude) on a side, by (a) humans, and (b) rivers

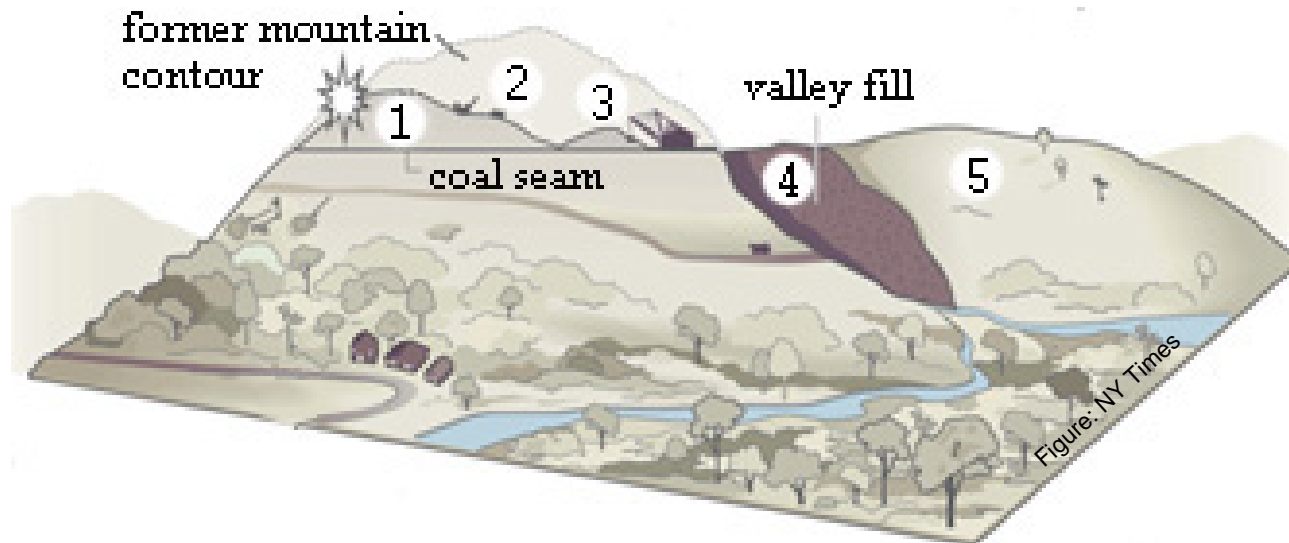


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# Surface coal mining in Central Appalachians



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# *Mountaintop removal and valley fill (MTR/VF)*

- >3000 km of headwater stream permanently buried by MTR/VF.
- Filling is regulated under §404 & §401 in CWA.
- Regulatory agencies must consider the impacts to stream structure and function when determining compensatory mitigation requirements for permitted actions.
- Recent federal litigation questioned the current assessment protocol because it does not directly measure possible impacts to stream function.



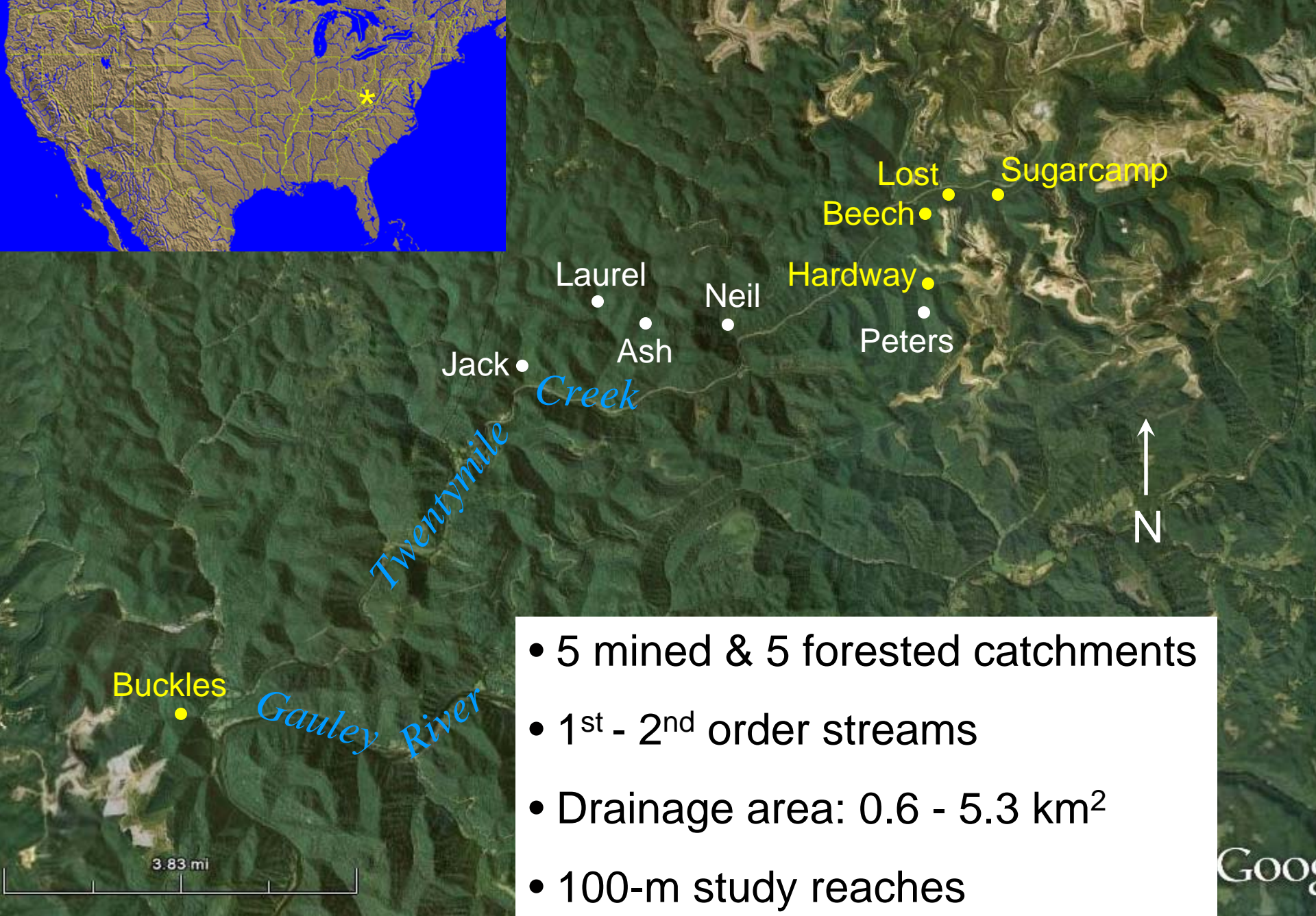


# Objectives

- Compare sediment and epilithon metabolism and hydrolytic activity in streams draining valley fills and forest.
- Assess relationships between structural and functional measures.
- Compare closed to open system metabolism estimates.







- 5 mined & 5 forested catchments
- 1<sup>st</sup> - 2<sup>nd</sup> order streams
- Drainage area: 0.6 - 5.3 km<sup>2</sup>
- 100-m study reaches







## *Methods – O<sub>2</sub> demand (OD) & fluorescein diacetate (FDA)*

### Epilithon

Silica disc = 5.31 cm<sup>2</sup>

Colonization 2 – 7 weeks

2 disc per rep (EOD & FDA)

### Sediment

top 2 cm

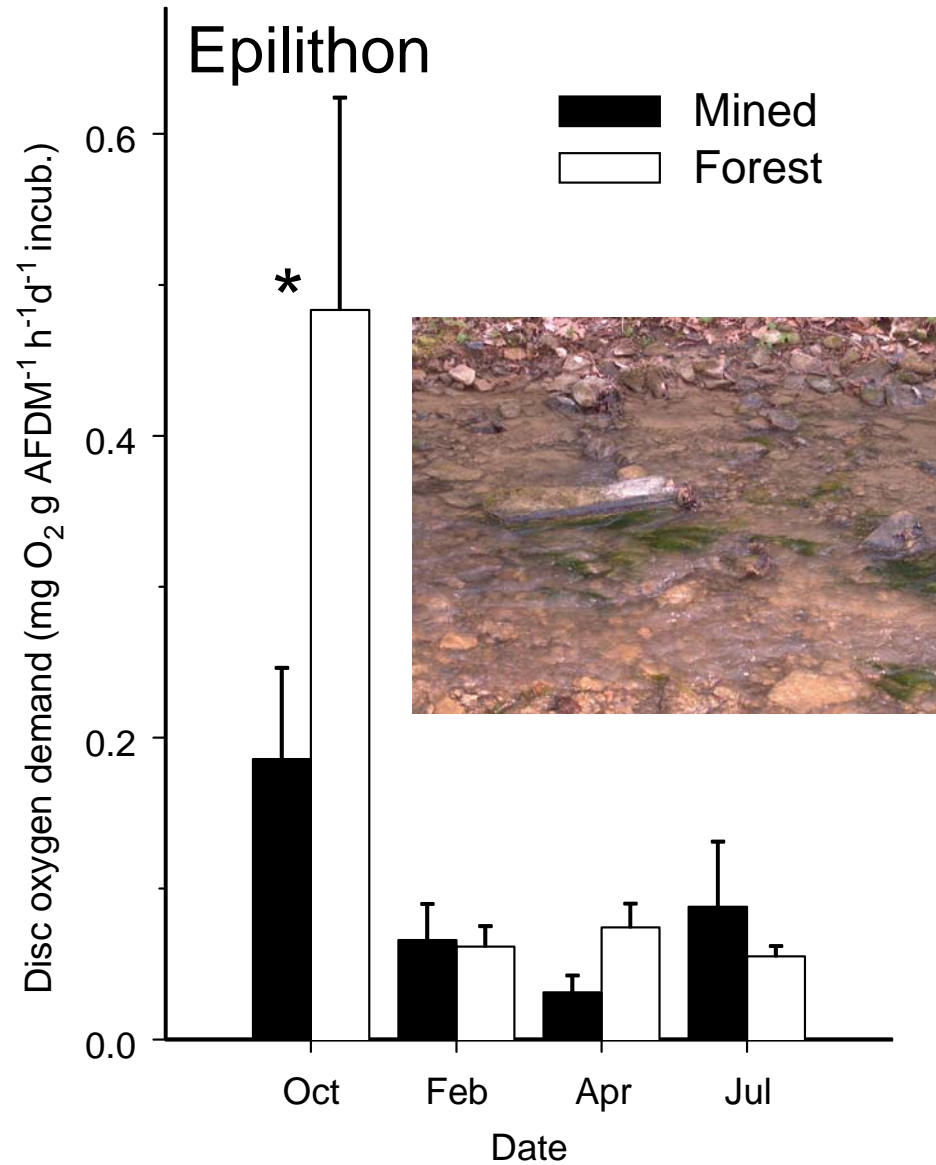
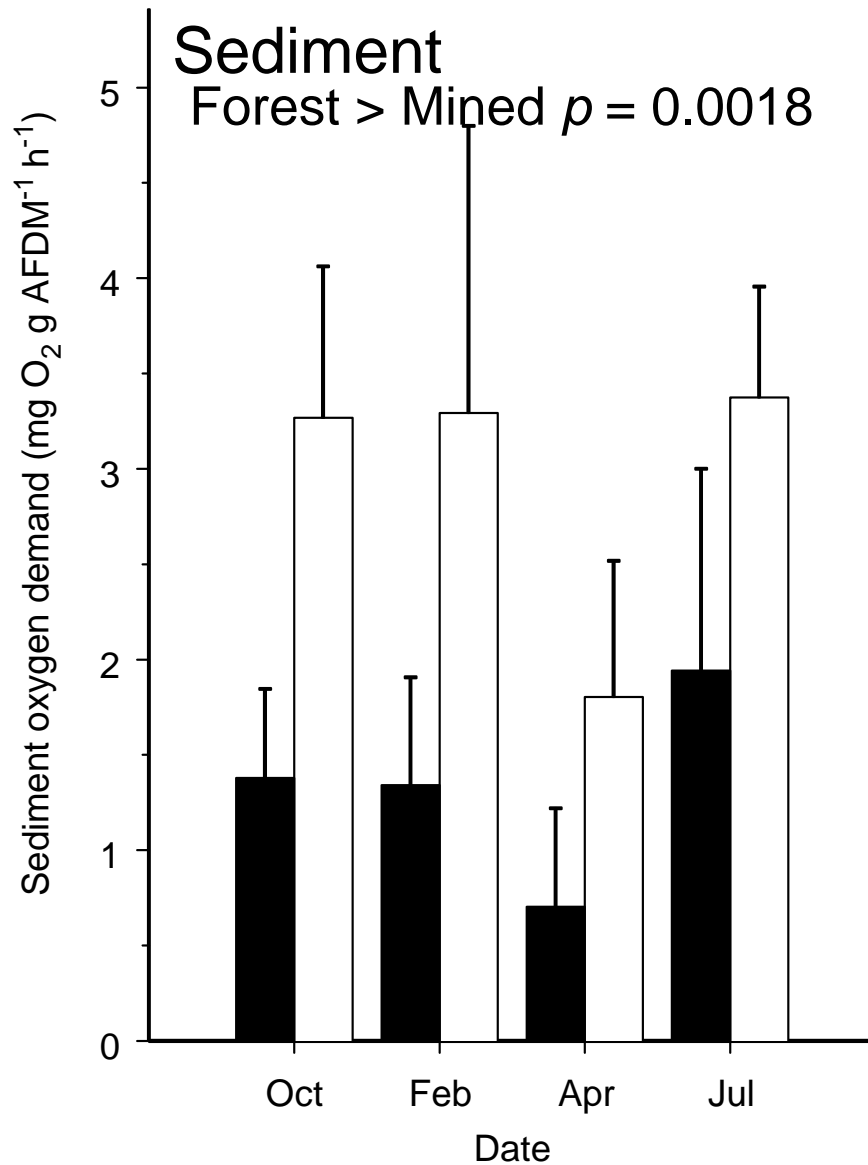
< 2mm grain size

10 ml (SOD) & 5 ml (FDA) per rep

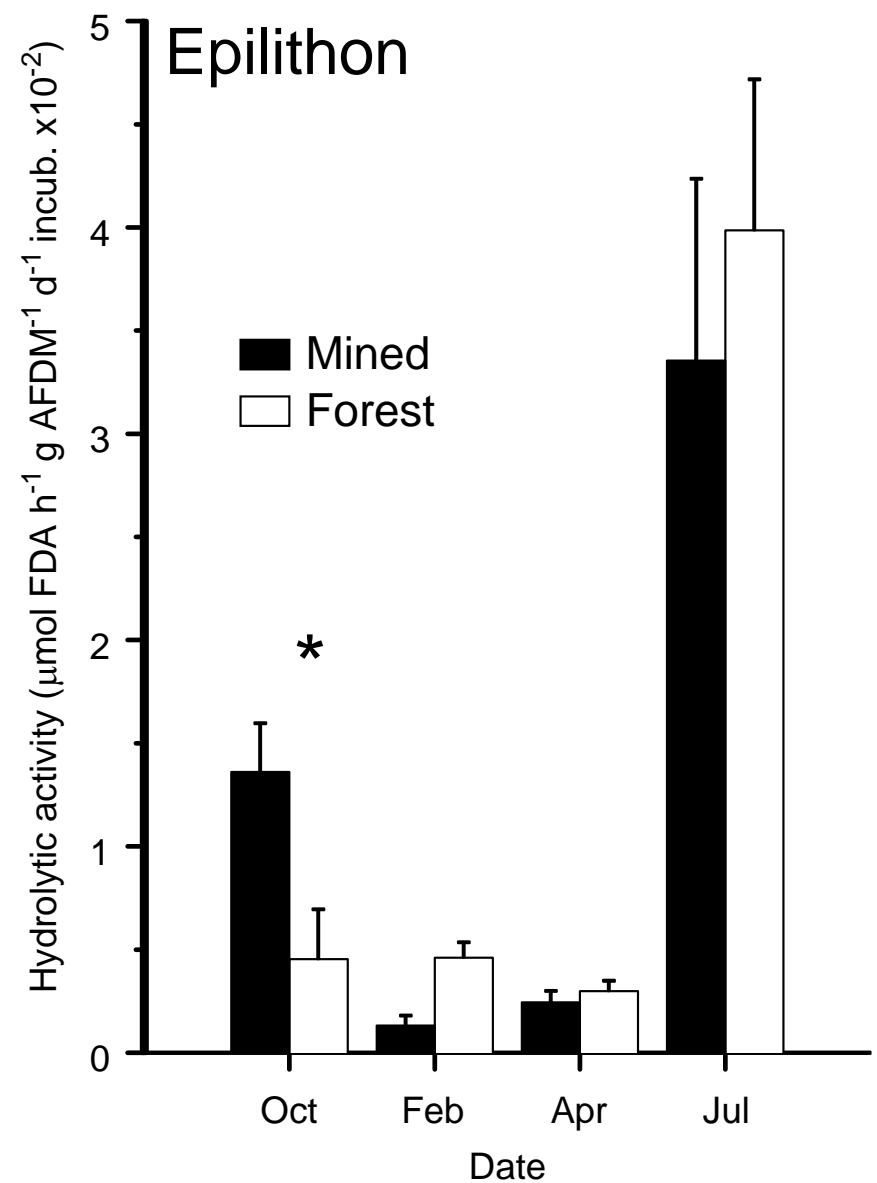
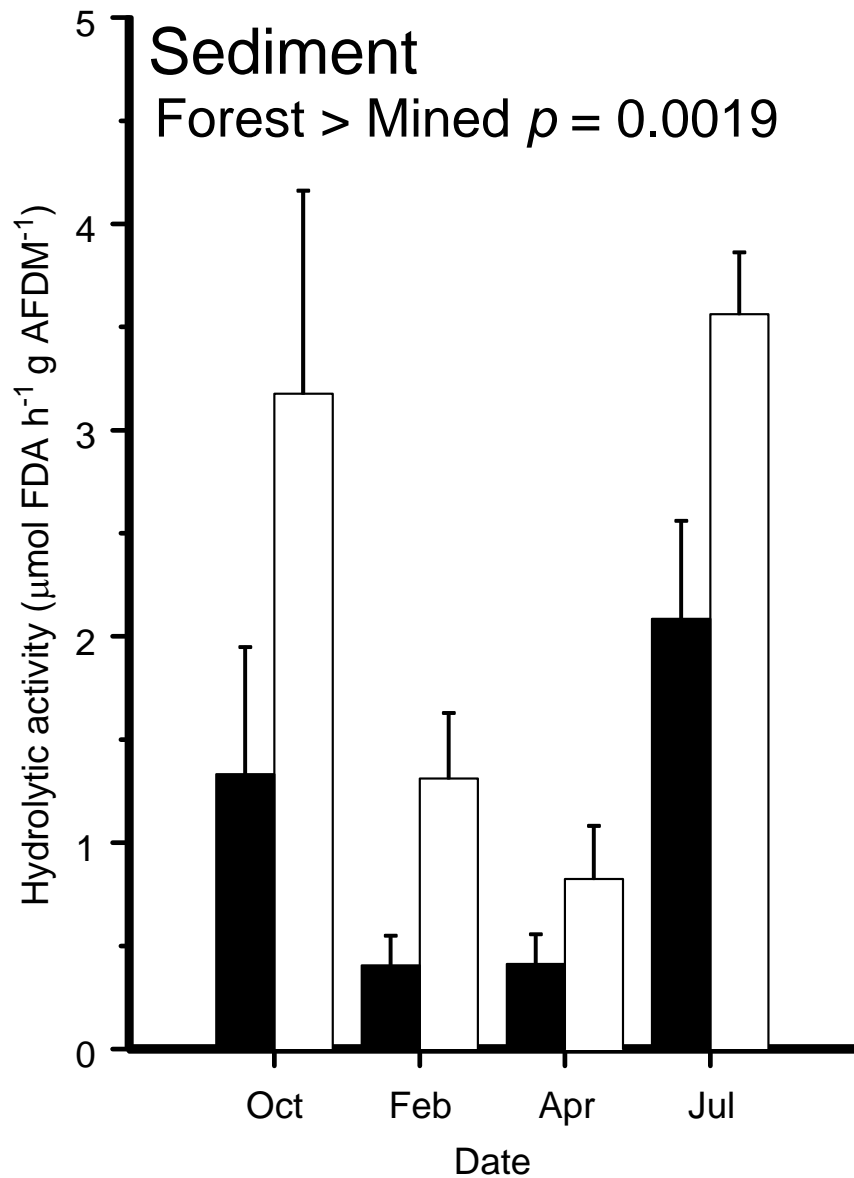
Incubation: 2-3 h (OD) & 30 m (FDA) at stream temperature



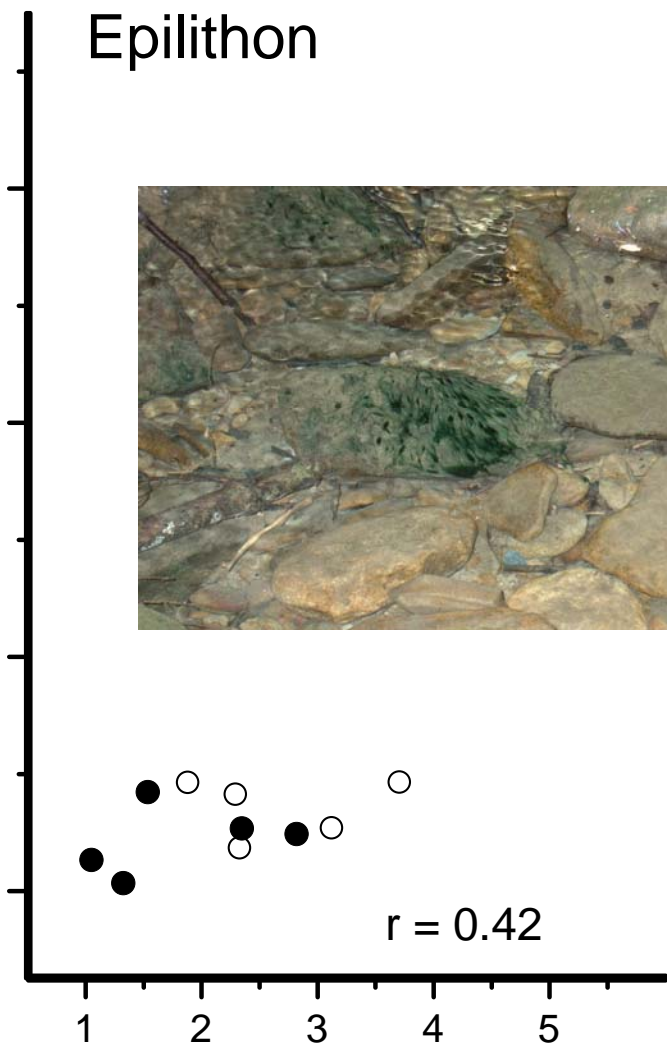
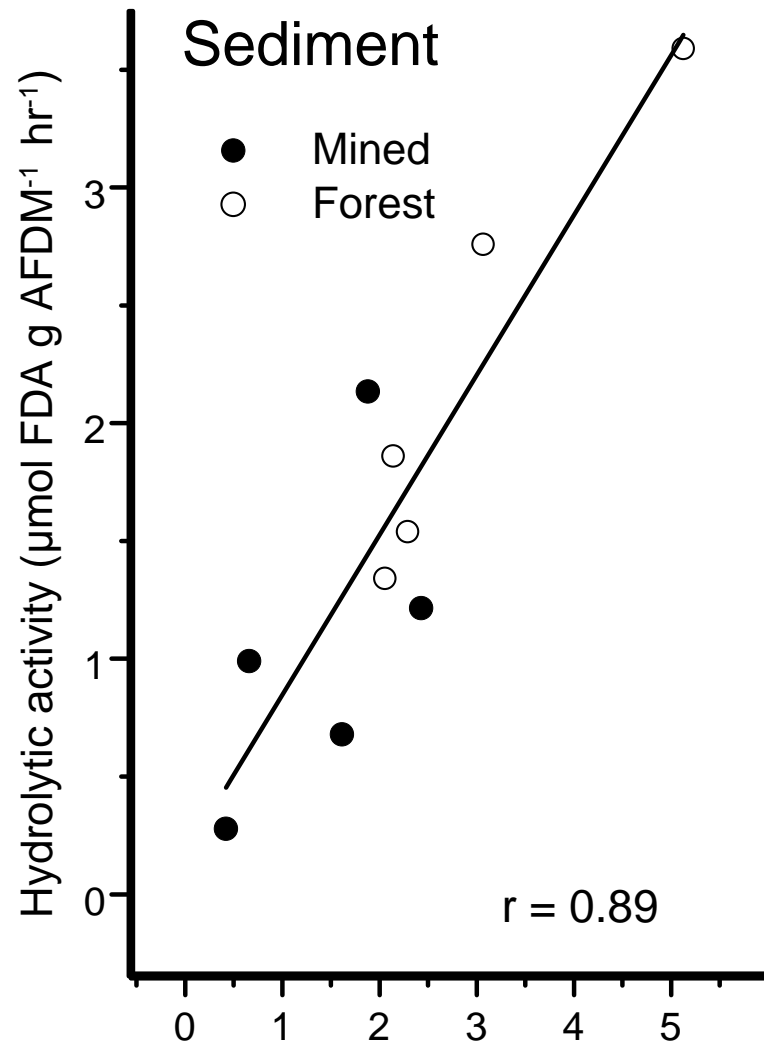
# Oxygen demand





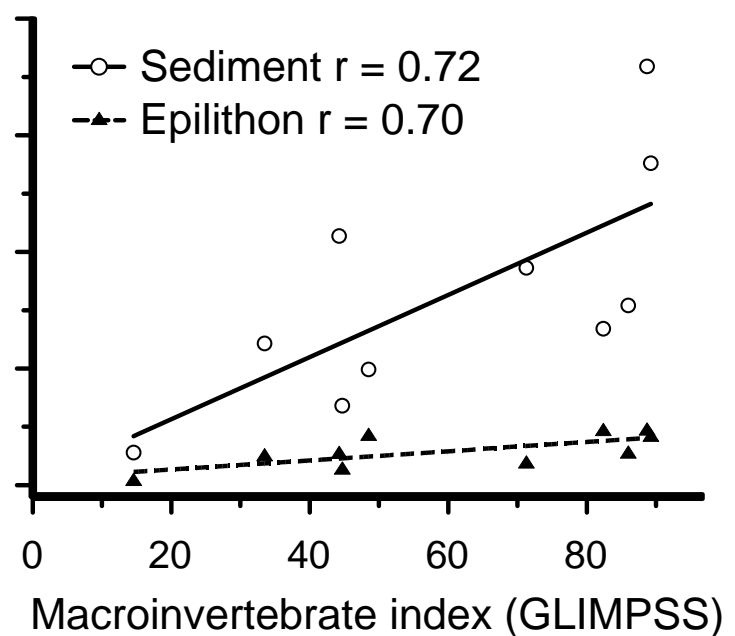
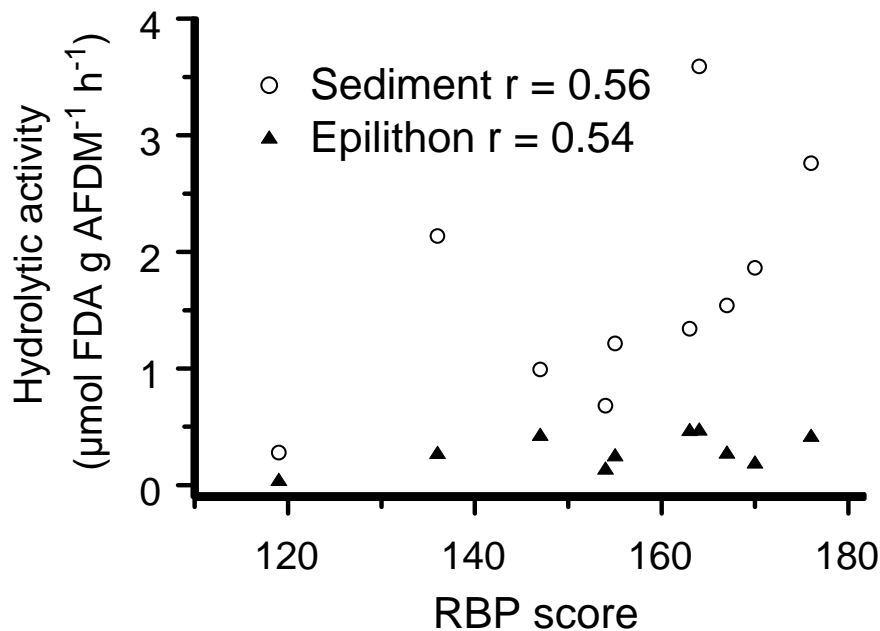
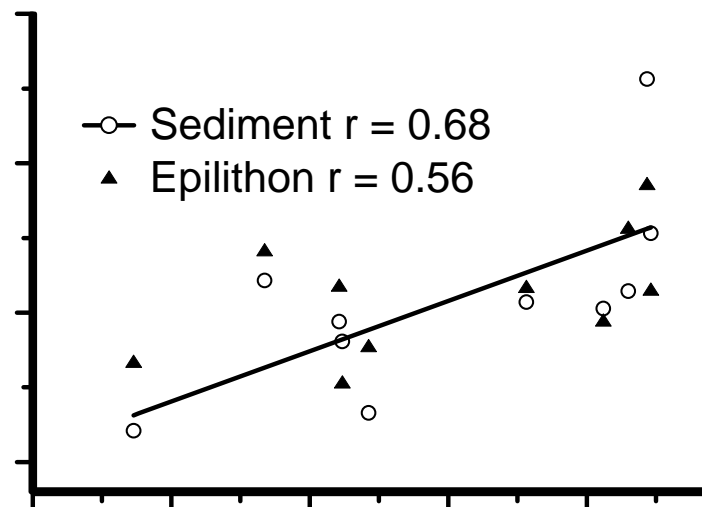
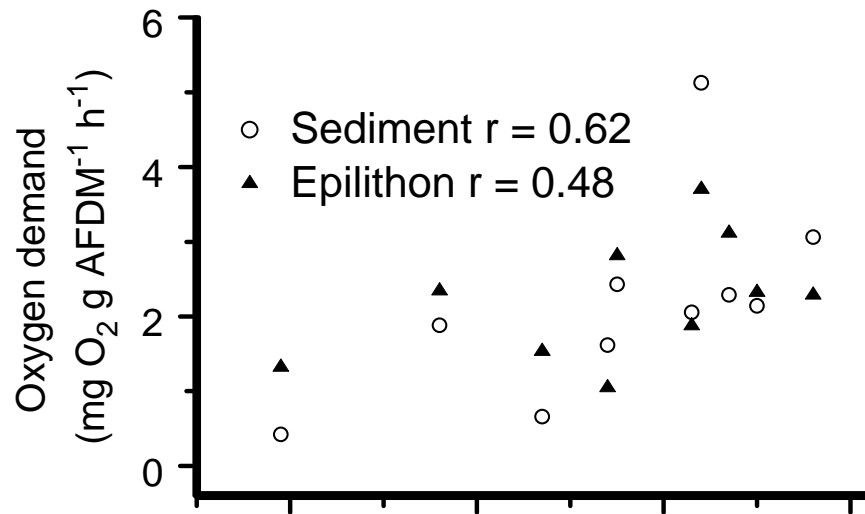


# Annual means OD-FDA

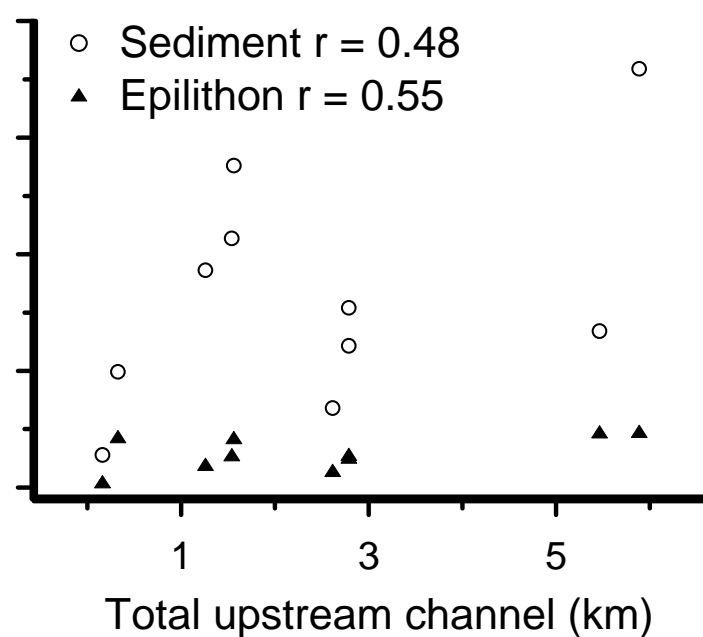
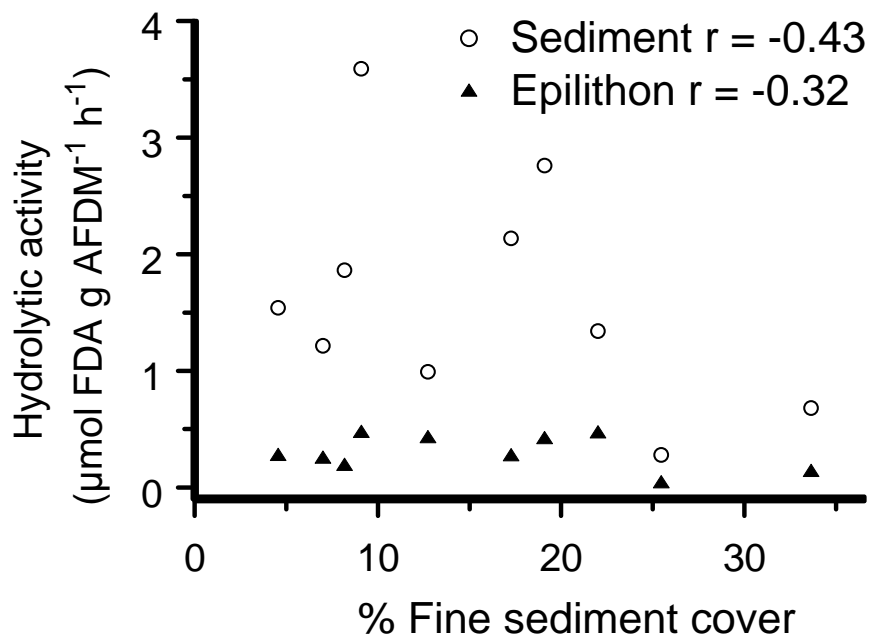
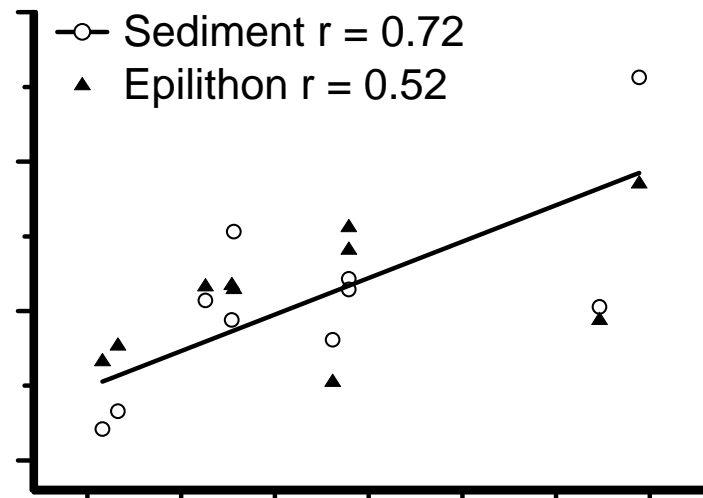
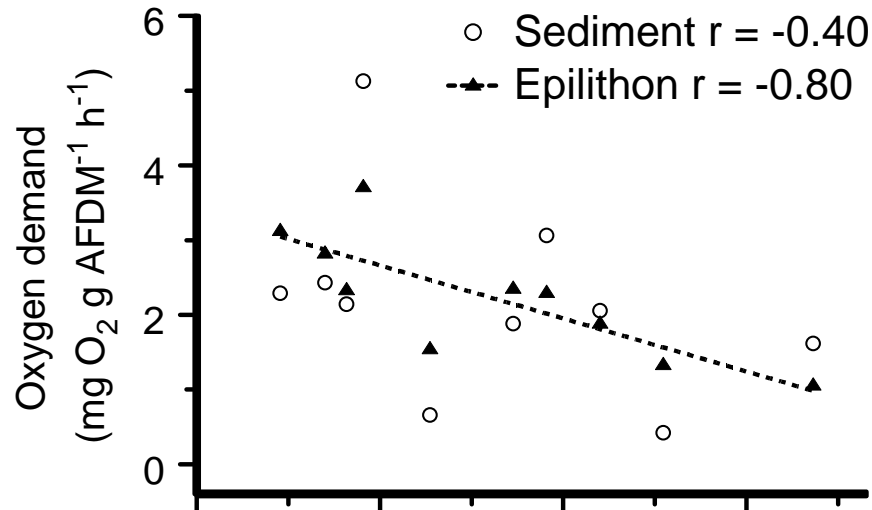




# Structure-function

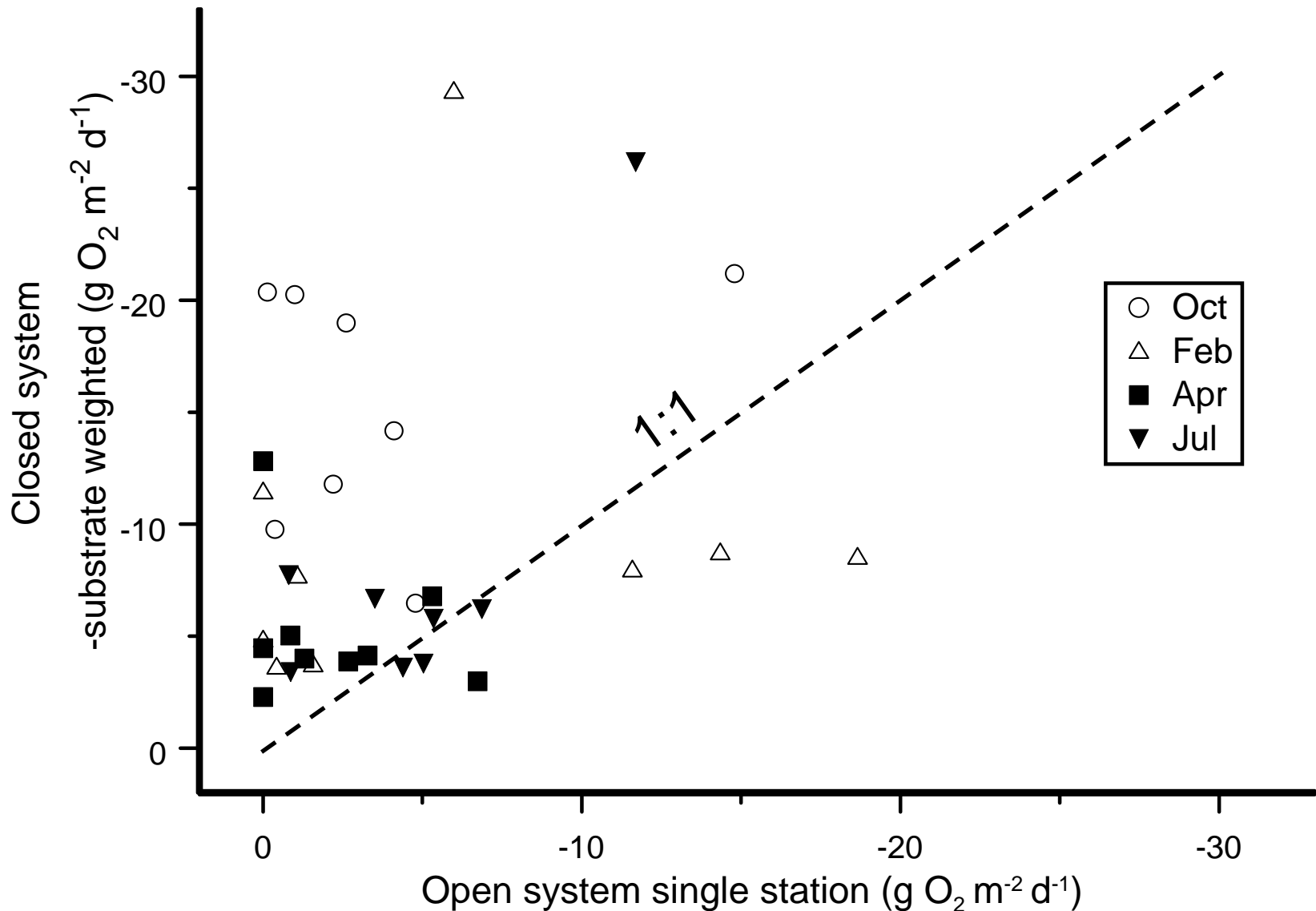


# Structure-function





# Respiration estimates: OD & single station



# Summary



- Oxygen demand and FDA have potential as regulatory assessment measures.
- These functions appear to be impacted by MTR/VF, through altered chemistry, sedimentation and truncating stream networks.
- Although some structural measures were correlated with oxygen demand & FDA, the mechanisms behind those relationships are unclear.
- Further research is needed to characterize possible recovery following reclamation and how recovery may be facilitated.





# Acknowledgements

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