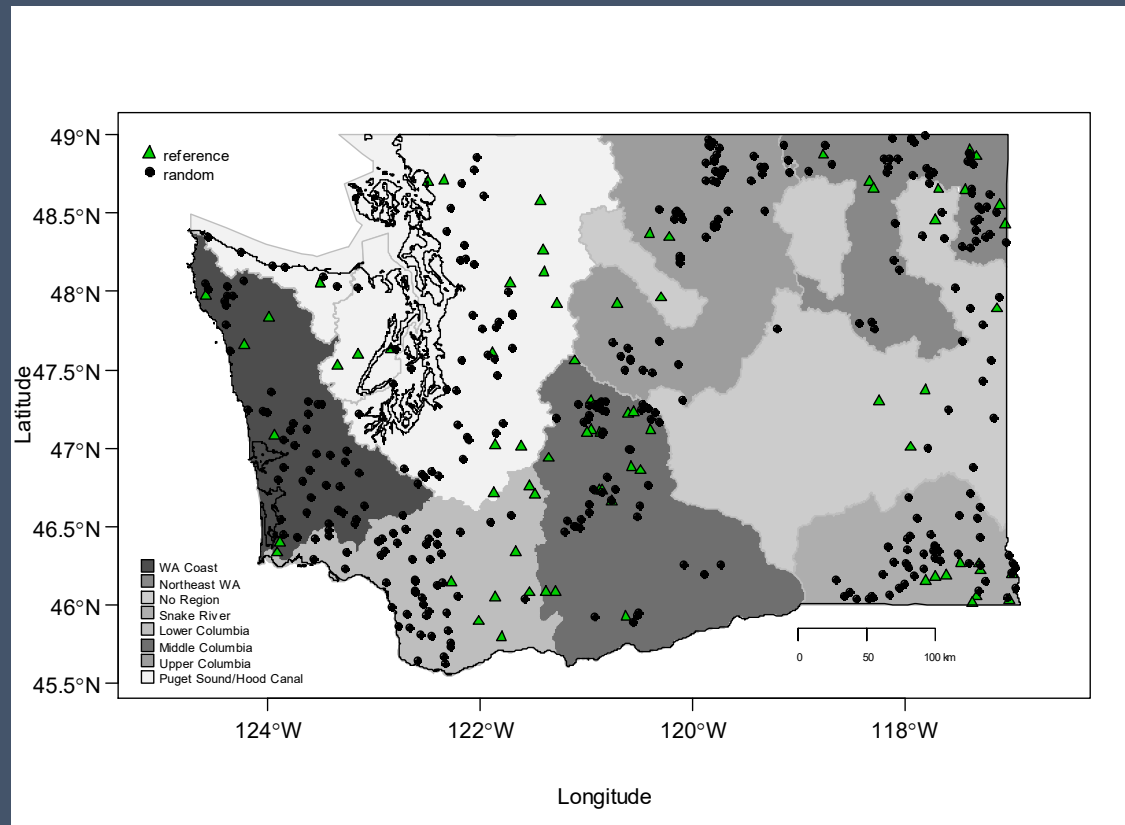


Direct and indirect impacts of anthropogenic stressors on stream macroinvertebrate communities across spatial scales: a structural equation modeling approach

Chad Larson

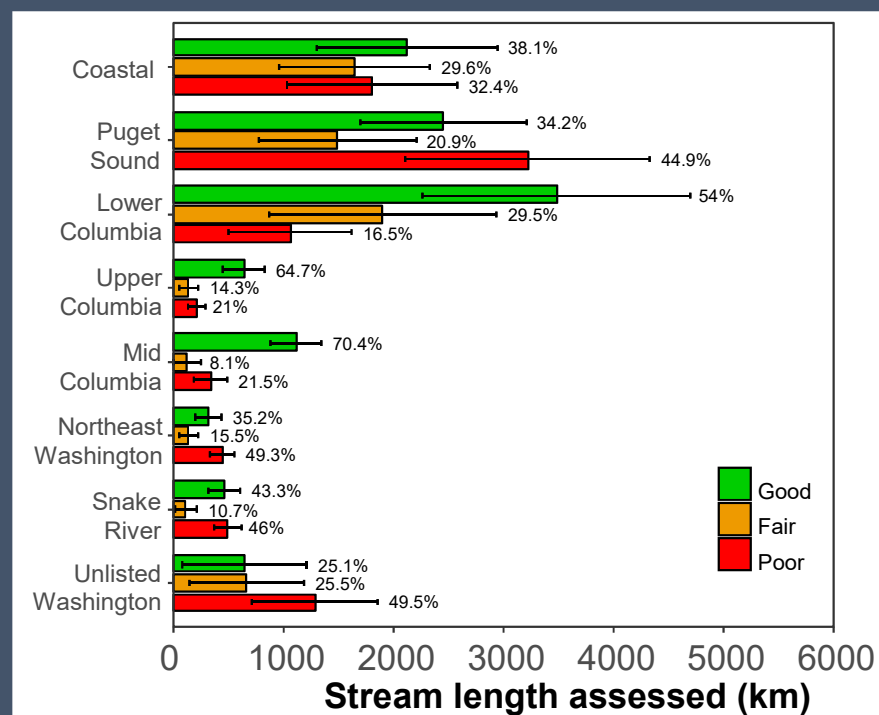
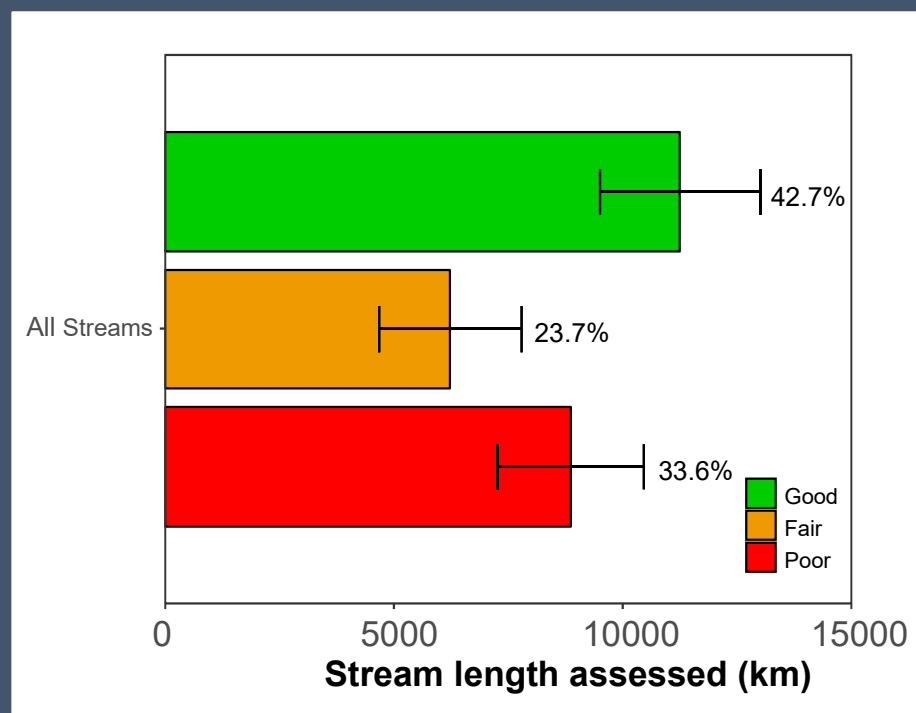
Environmental Assessment Program

Washington State Department of Ecology



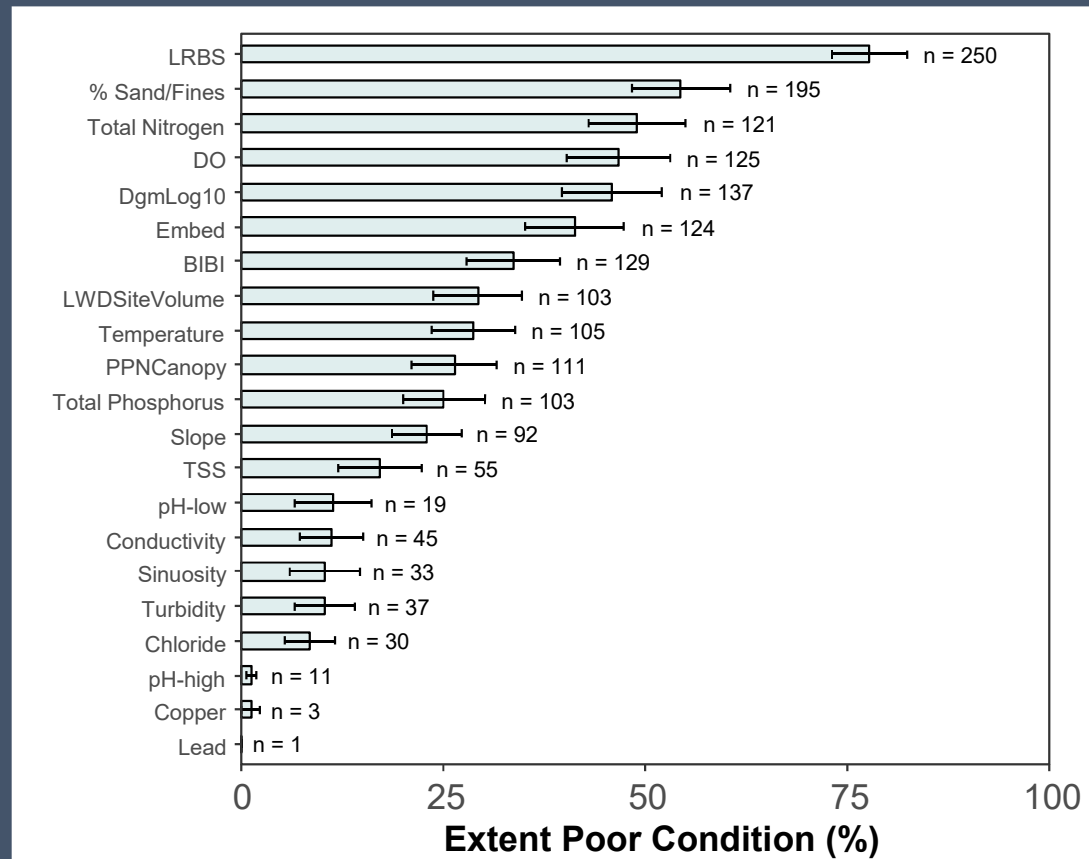
Larson et al. 2019, *Ecological Indicators* 102: 175-185

Biological condition as assessed with B-IBI



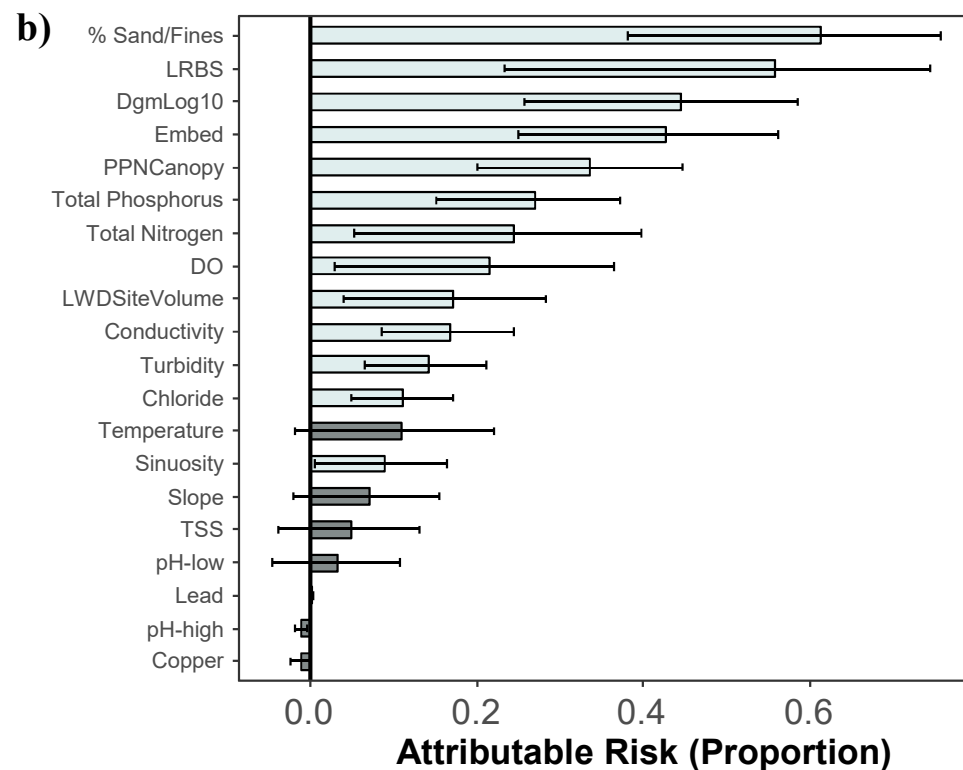
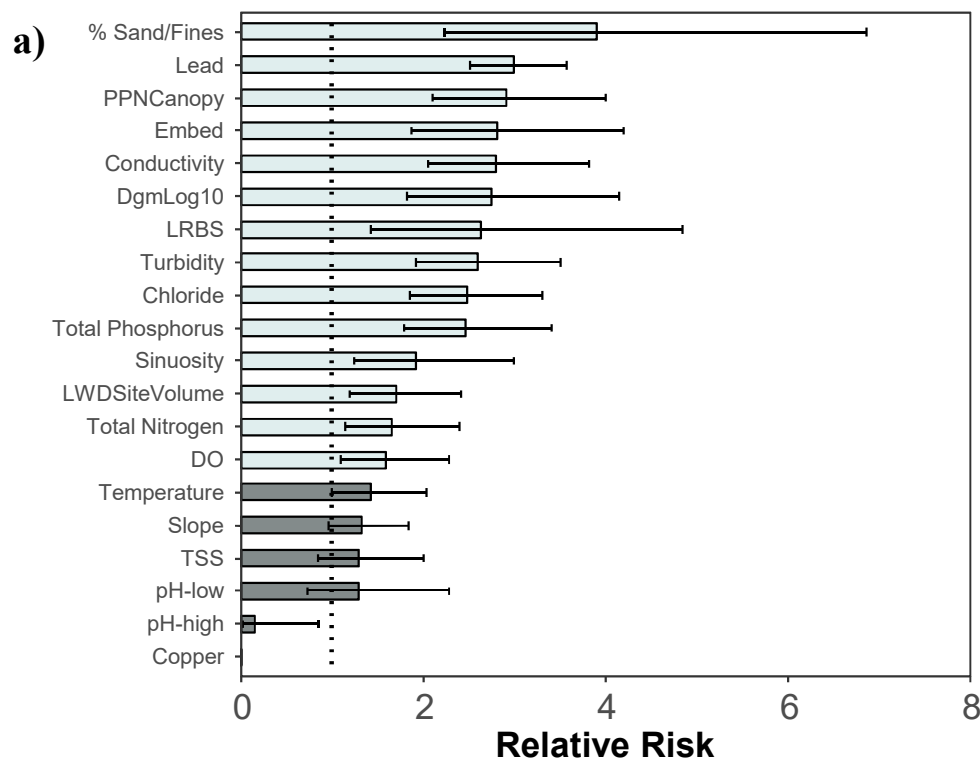
Larson et al. 2019, *Ecological Indicators* 102: 175-185

Most prevalent stressors

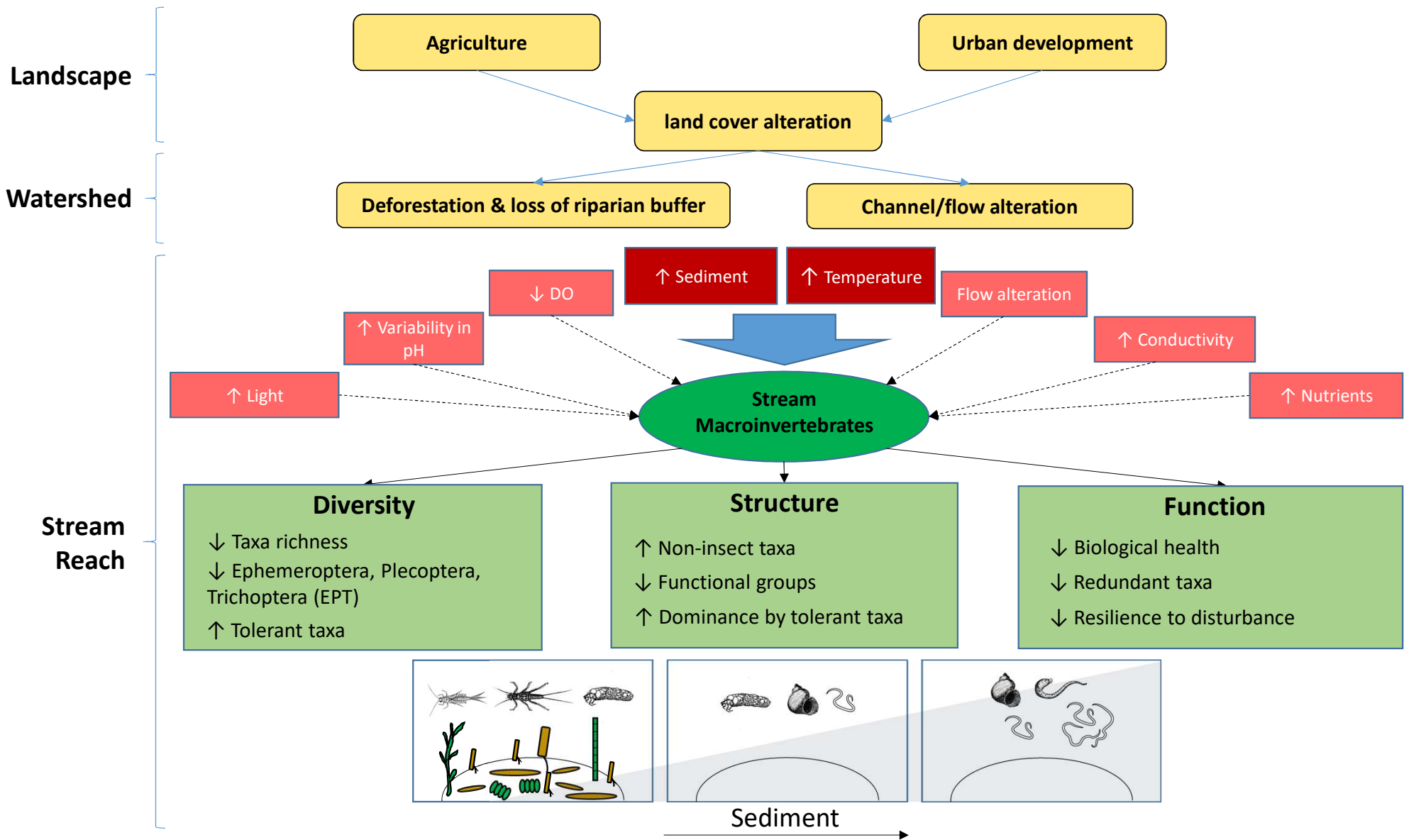


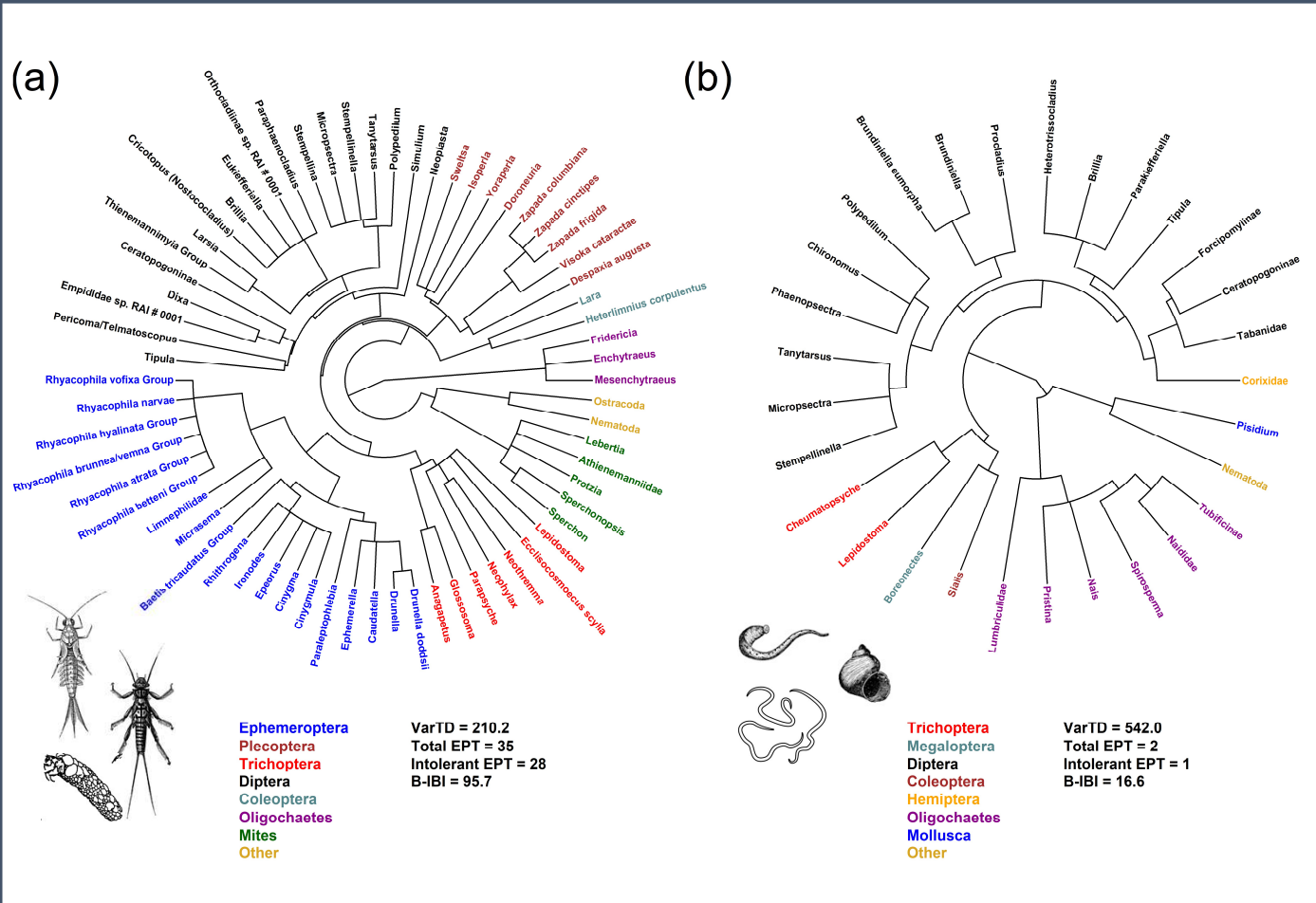
Larson et al. 2019, *Ecological Indicators* 102: 175-185

Relative Risk/Attributable Risk



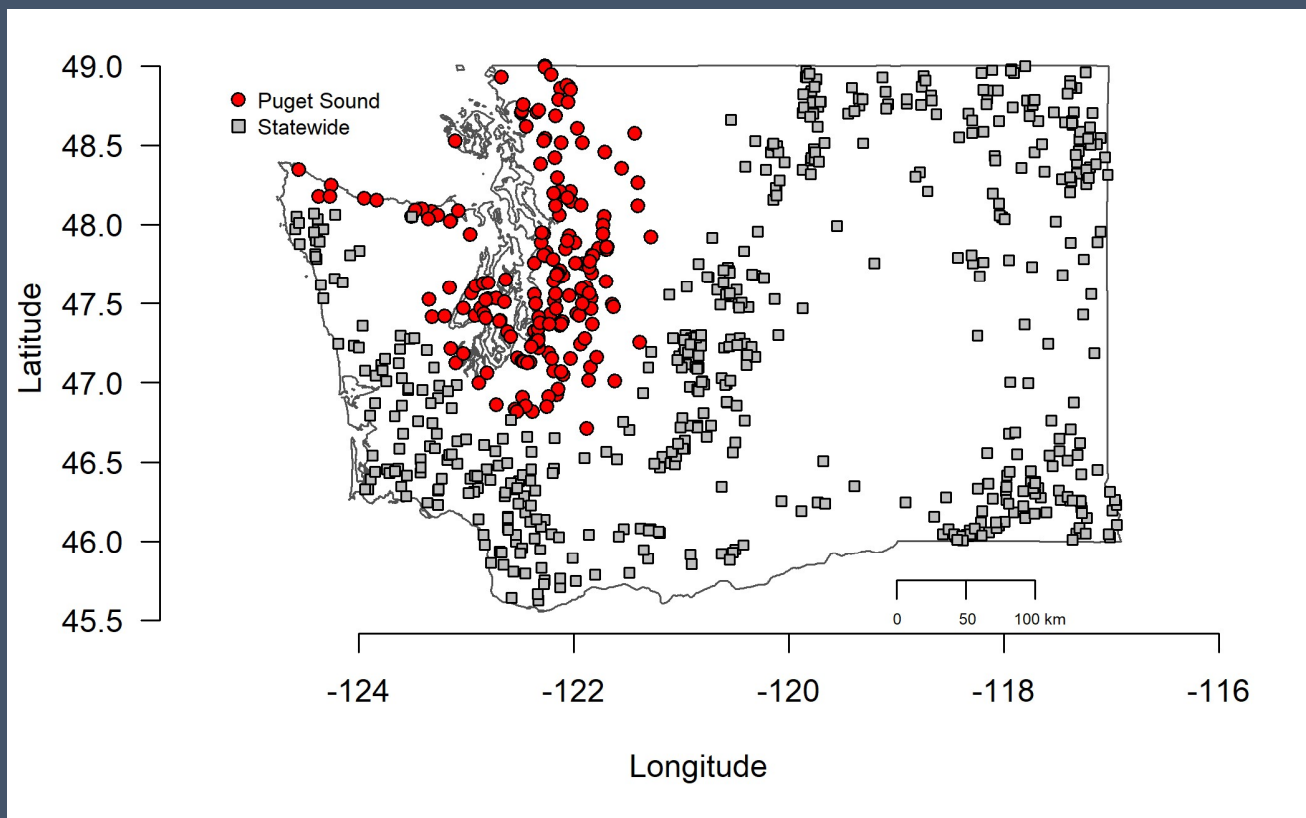
Larson et al. 2019, *Ecological Indicators* 102: 175-185



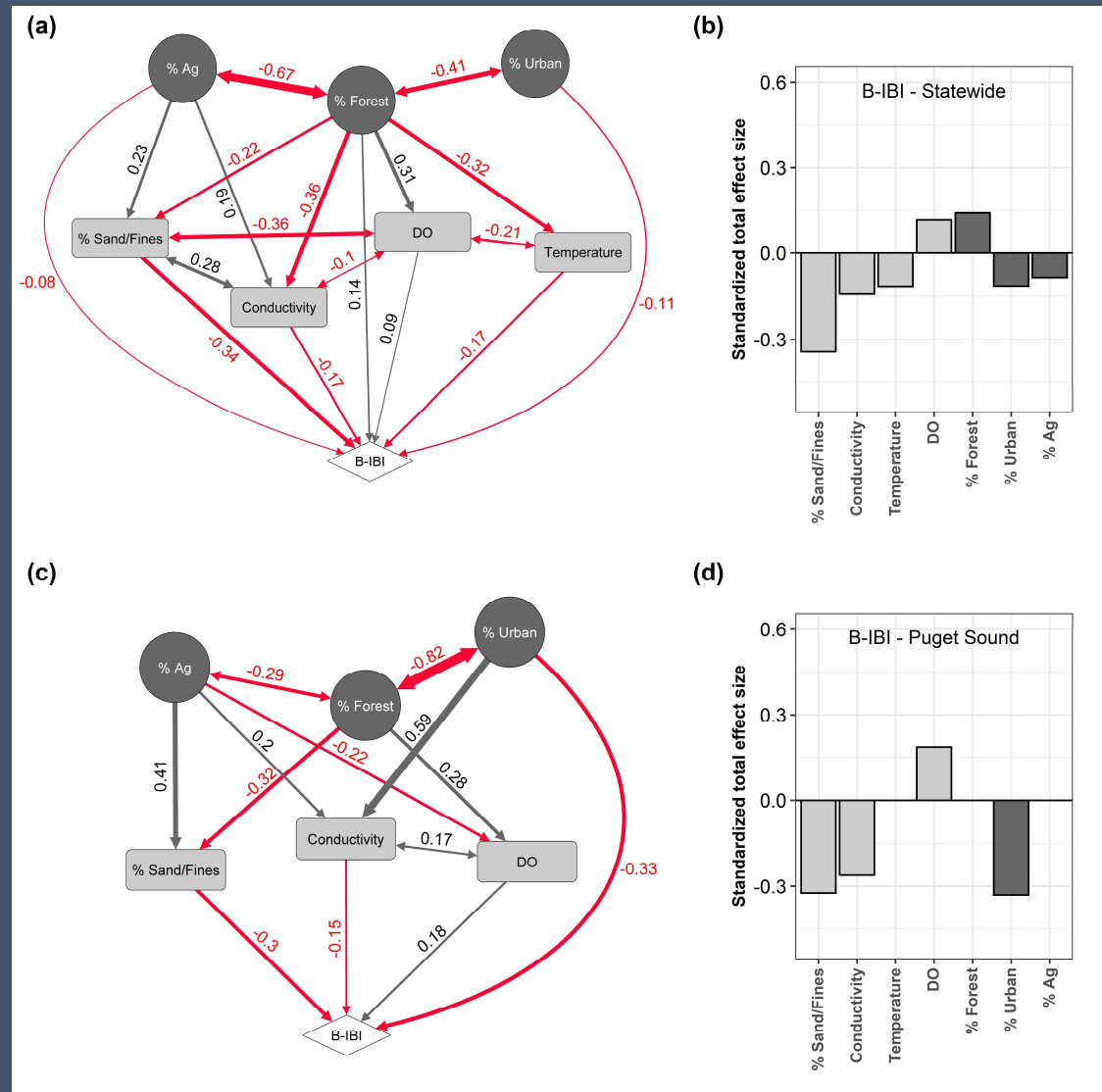


765 Sites

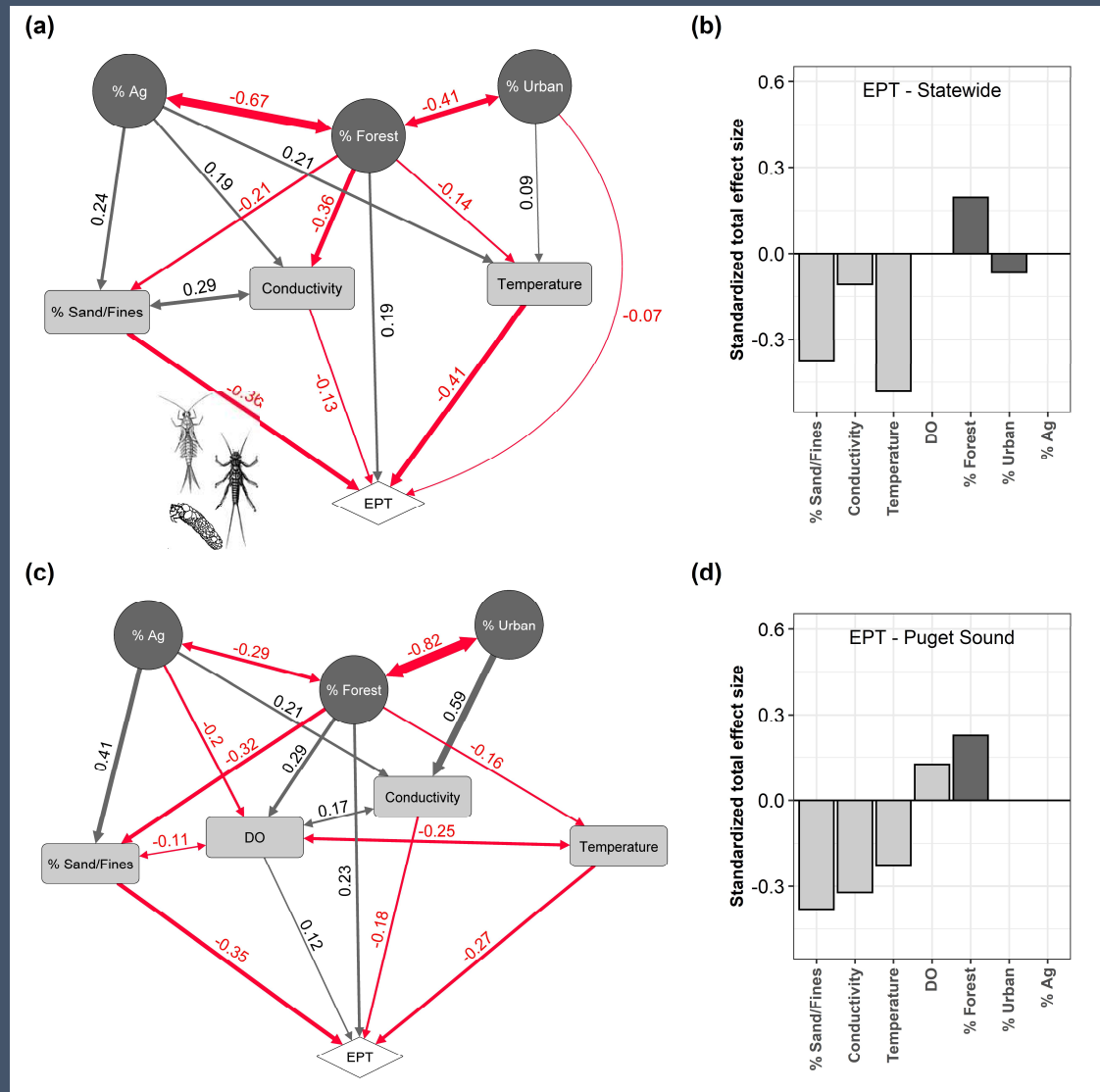
203 Sites in Puget
Sound region



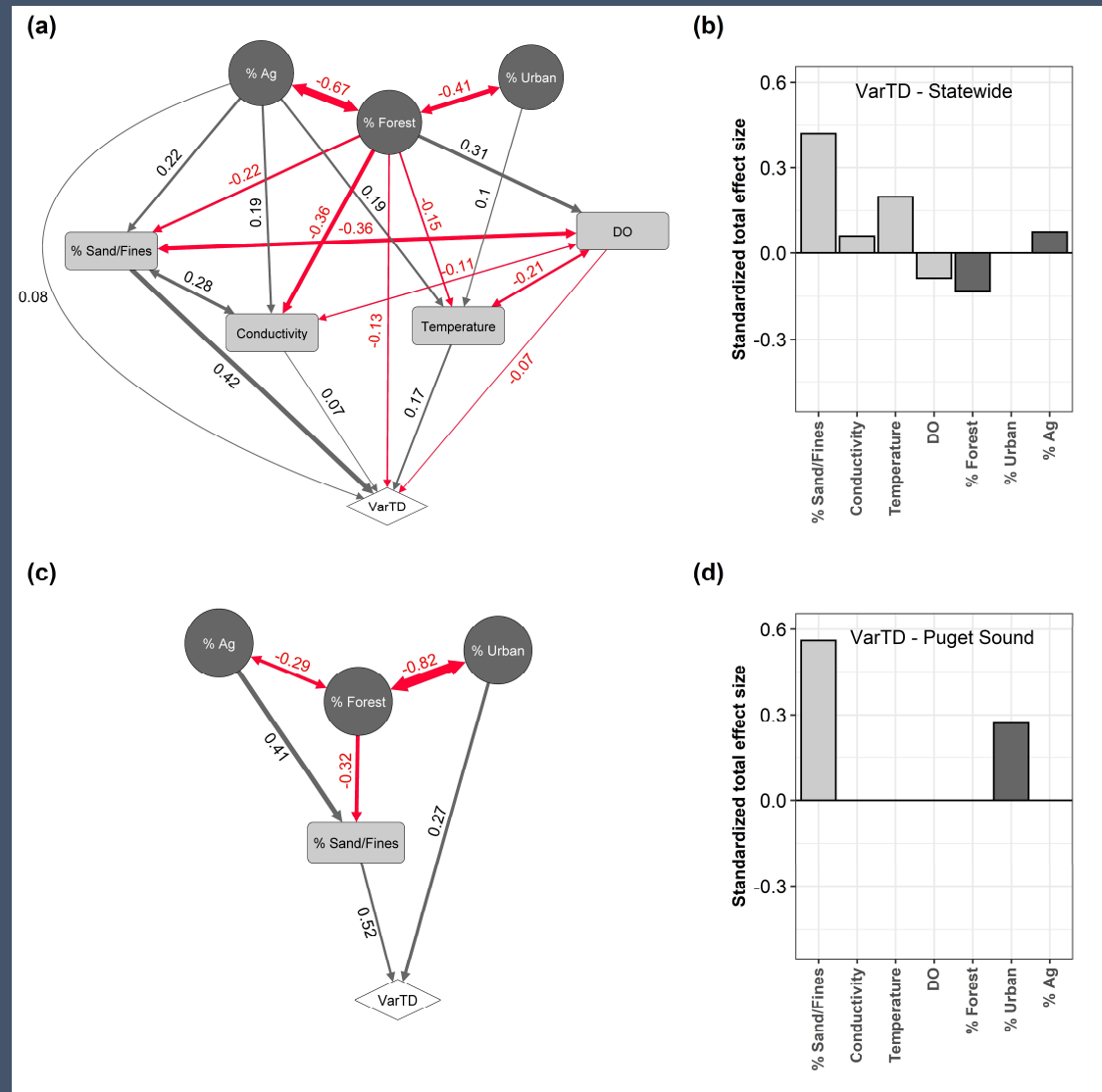
- Statewide:
 - $R^2 = 0.510$; RMSEA = 0.052, p-value = 0.406
- Puget Sound:
 - $R^2 = 0.434$; RMSEA = 0.066, p-value = 0.263



- Statewide:
 - $R^2 = 0.616$; RMSEA = 0.050, p-value = 0.451
- Puget Sound:
 - $R^2 = 0.548$; RMSEA = 0.064, p-value = 0.262



- Statewide:
 - $R^2 = 0.442$; RMSEA = 0.058, p-value = 0.248
- Puget Sound:
 - $R^2 = 0.434$; RMSEA = 0.063, p-value = 0.312



Summary

- Macroinvertebrate communities impacted by many interacting factors from multiple spatial scales
- Increased sediment associated with loss of forest cover related to land use, i.e., urbanization and agriculture
- Sediment deposition negatively impacting stream macroinvertebrates
- Elevated water temperatures impacting EPT taxa
- Loss of sensitive taxa with elevated sediment and water temperatures