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PNNL River Corridor Science: YRB Field Campaign Updates

Lower Yakima River Water Quality and Habitat Coordination
October 26, 2021

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U.S. DEPARTMENT OF ENERGY BATTELLE

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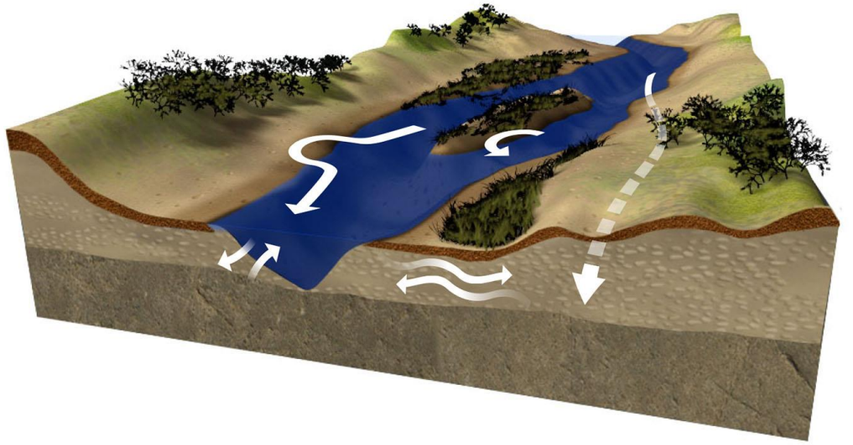
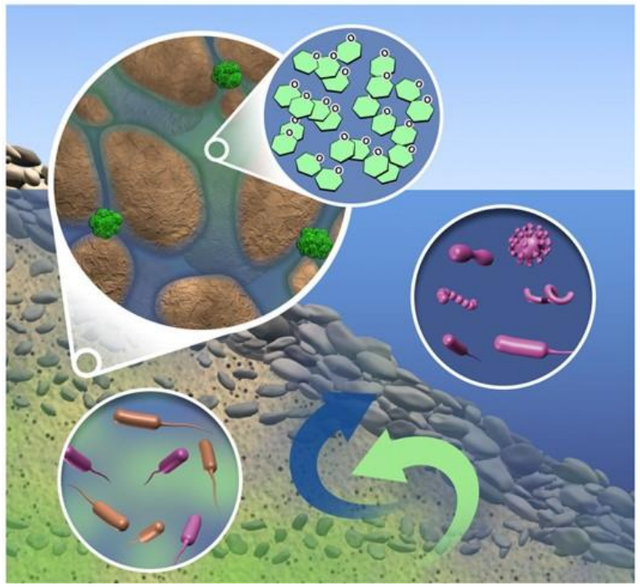
Watershed function is an emergent outcome of complex hydrologic and biogeochemical processes acting at molecular to basin scales

Hydrologic Exchange Flows (HEFs)

The dynamic exchange of water, and its chemical and biological constituents, between river channels and adjacent environments.





Biogeochemical Processes

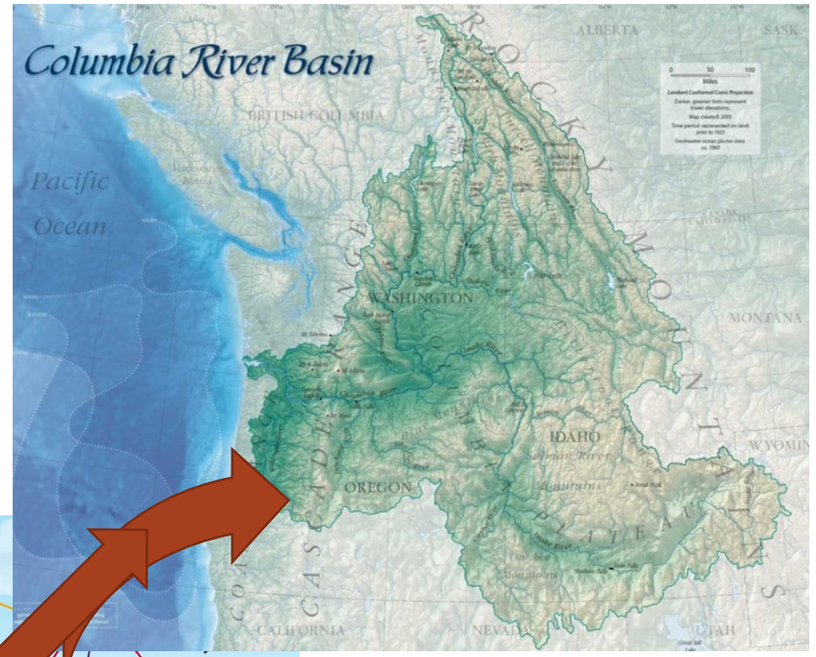
Transformations of key nutrients (C, N, P) and contaminants (e.g., NO_3) through physical transport, mixing, and interactions with organic matter, microbes, minerals, and other aqueous species.

Our scientific grand challenge is motivated by critical knowledge gaps

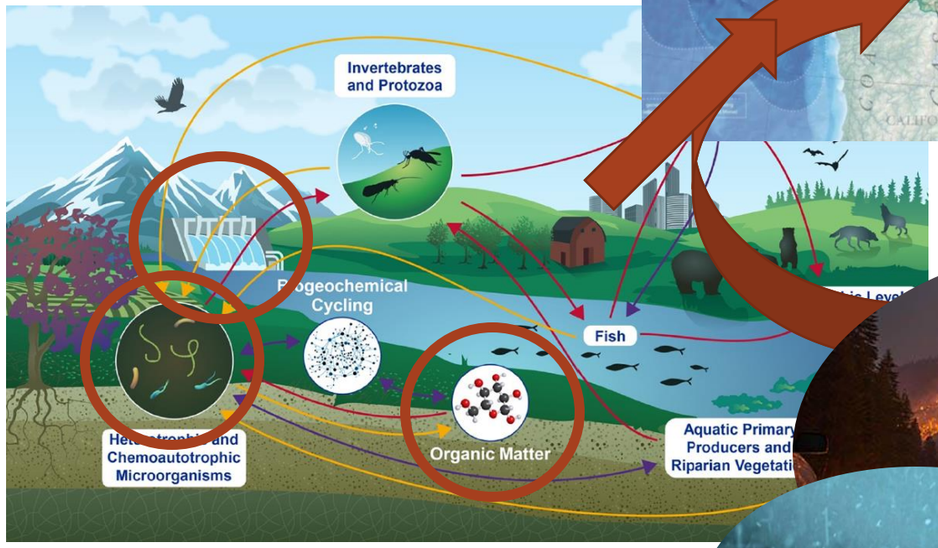
Grand Challenge

Understand and quantify processes governing the cumulative effects of **HEFs, organic matter (OM) chemistry, microbial activity**, and **disturbances** on river corridor hydro-biogeochemical functions at watershed to basin scales

Cumulative Effects

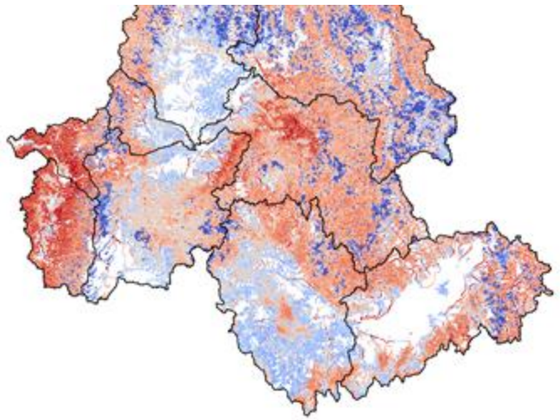


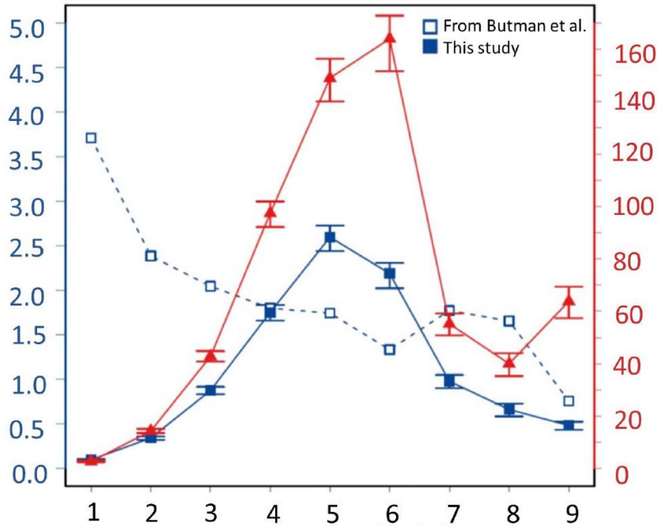
Mechanisms

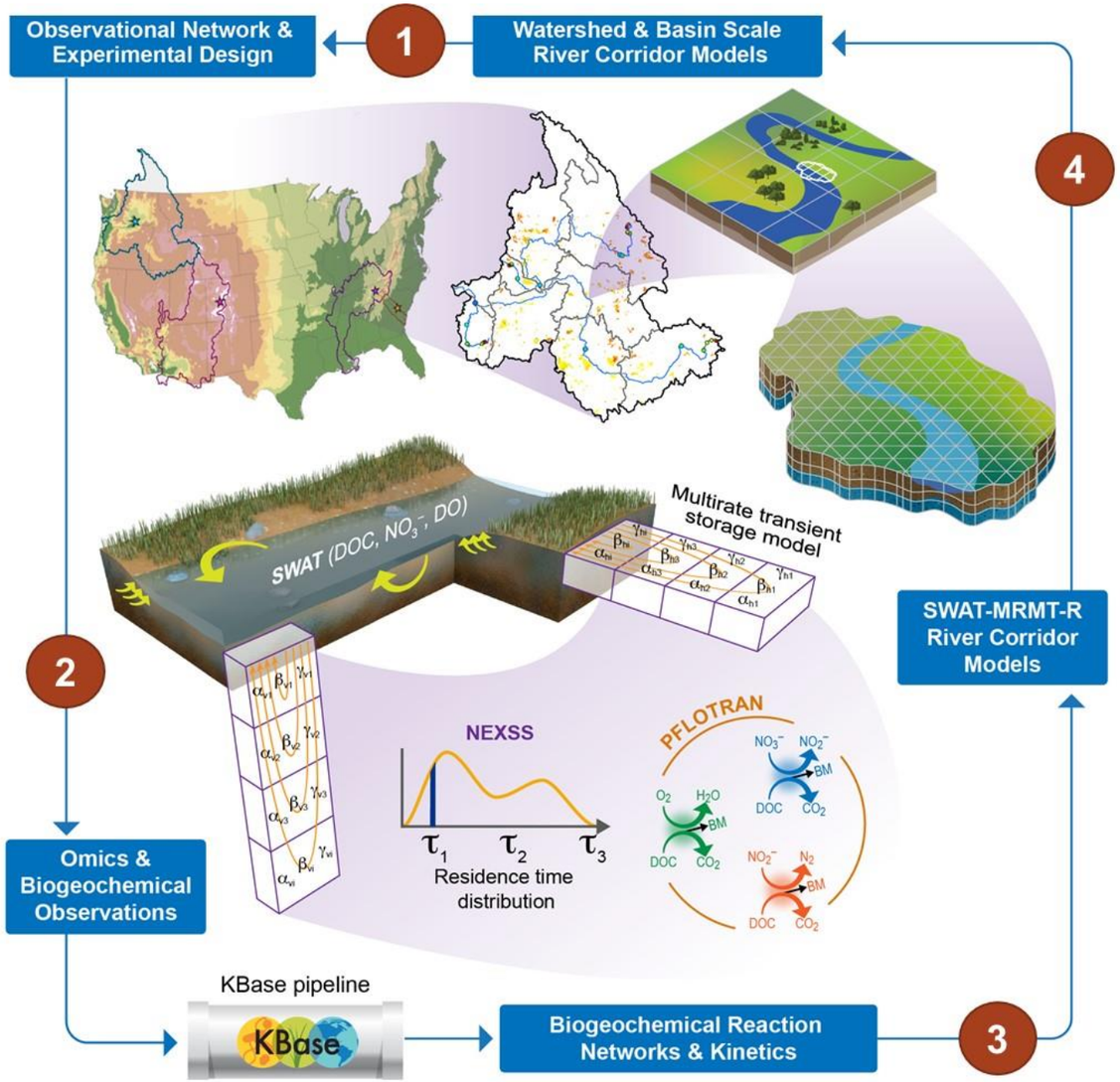


Disturbances

ModEx – Iterative Model-Experiment Learning Cycle







Hydrobiogeochemical Variability (RC-2) Motivating Knowledge Gaps

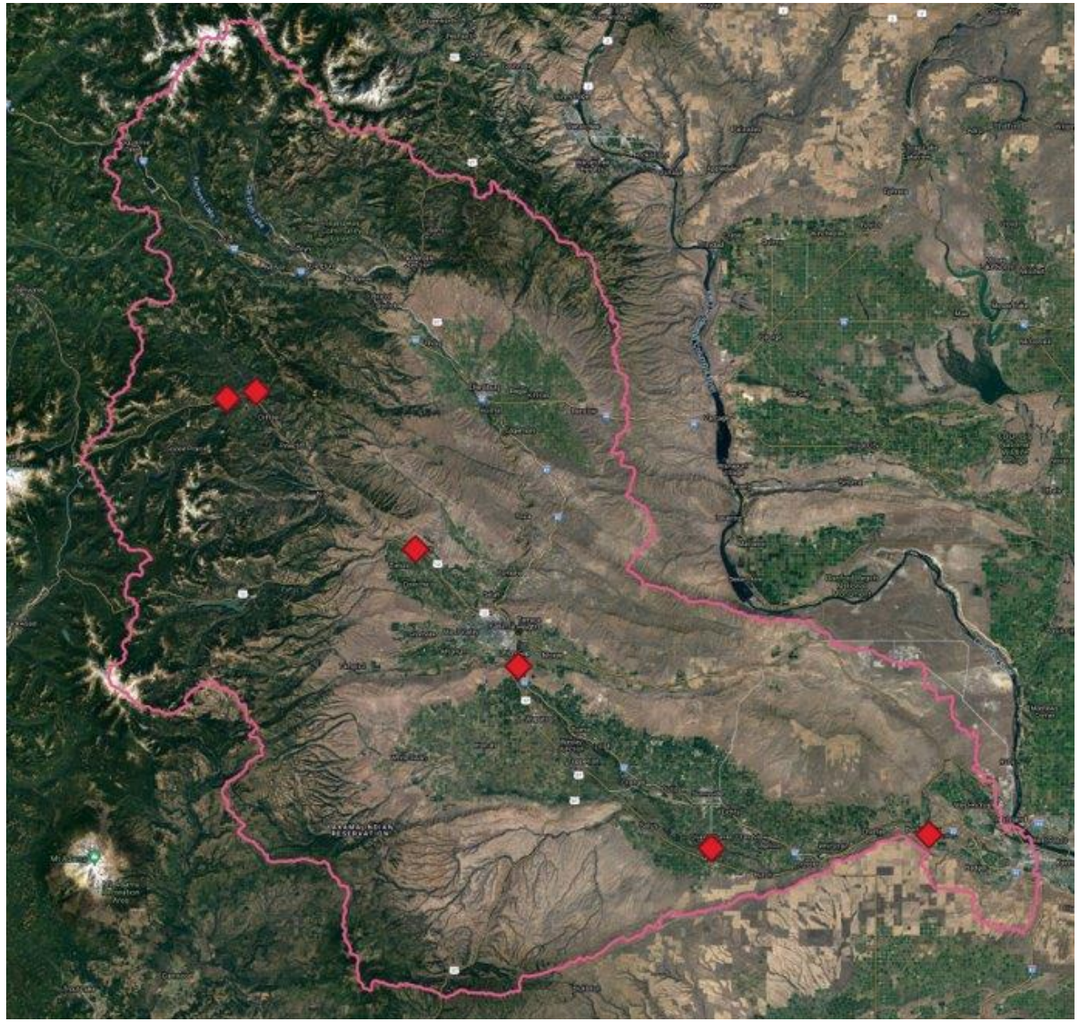
Contributions of sediment-associated biogeochemistry to river corridor metabolism

Variation in DOM chemistry, microbial gene expression, nutrients, and their association with sediment biogeochemistry

Consequences of variation in DOM chemistry, microbial gene expression, and nutrients for biogeochemical function

ERsed = ERtot - ERwater

Hydrobiogeochemical Variability (RC-2) Field Sites

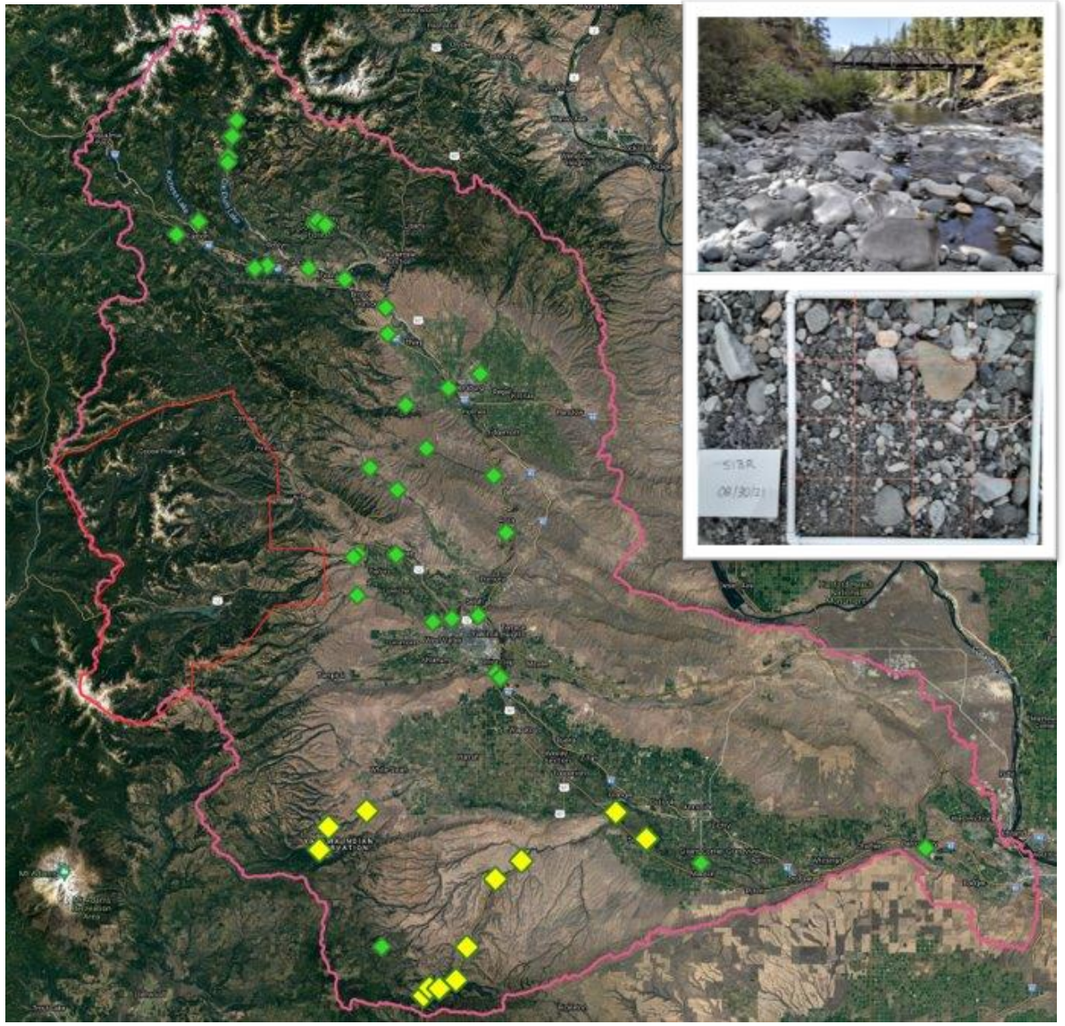


(Ongoing Data Generation)

RC2 Temporal Studies

- Sites chosen via modex
- 6 sites visited weekly starting in April 2021
- Spot readings (manta)
  - Temp, conductivity, turbidity
- Spectrolyser spectra captured
- Samples collected for
  - NPOC, TN, ICR, DIC, TSS, ions, metagenomics, amino acids
- Autochamber deployments starting this week
  - Parsing respiration between water column and sediment

Hydrobiogeochemical Variability (RC-2) Field Sites



(Fieldwork Complete)

RC2 Spatial Study (all dots)

- Sites chosen via modex w/ modifications
- 47 sites visited once each in late august/early sept
- Spot readings (manta)
  - Temp, conductivity, turbidity, pH
- Triplicate open-channel respiration measurements
- Samples collected for
  - NPOC, TN, ICR, DIC, TSS, ions, metagenomics, amino acids

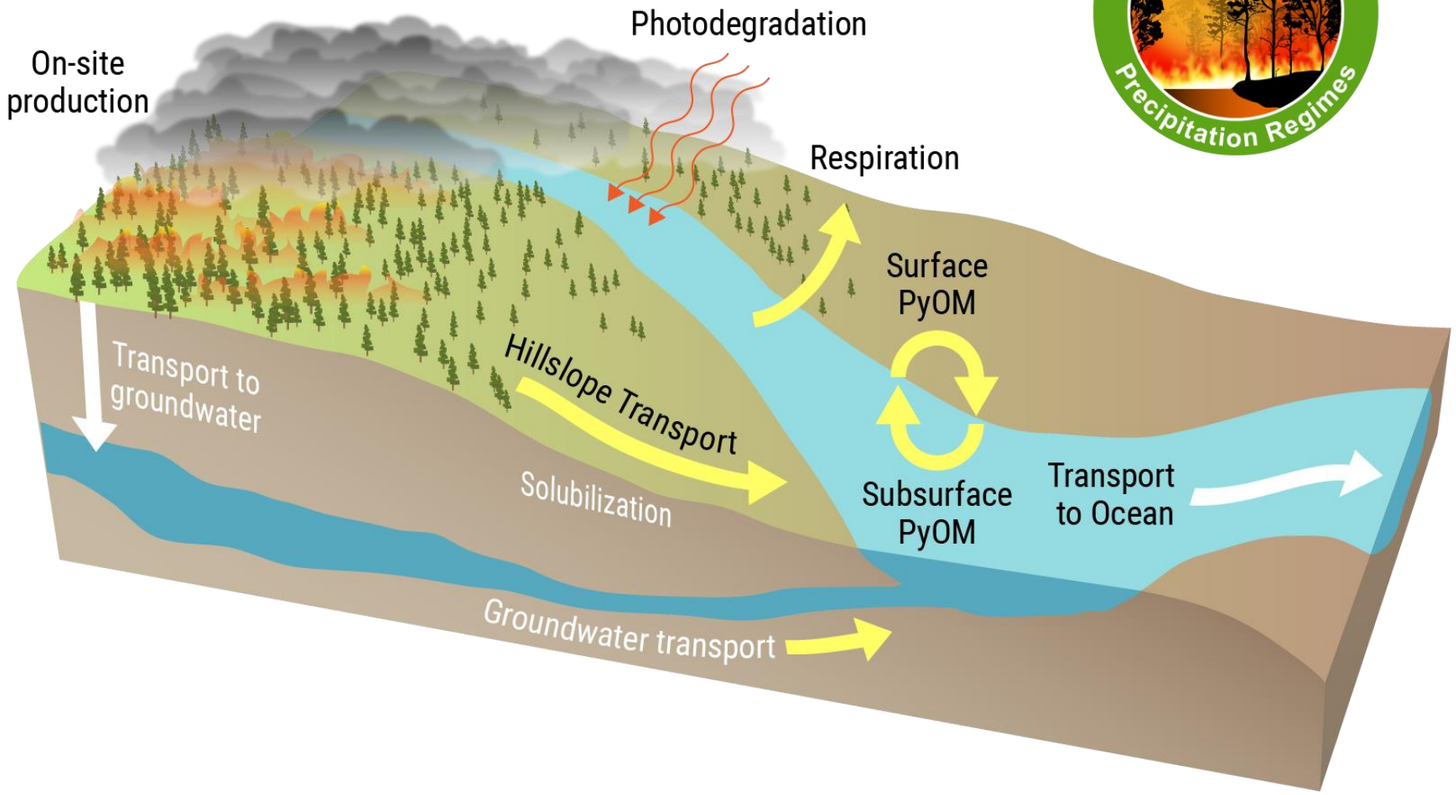
Ecosystem Respiration Pilot (yellow dots)

- 12 sites in the Satus Creek watershed (permit-driven)
- Time-series open channel dissolved oxygen recorded for ~2+ weeks
- ~10 depth transects from each site
- Data to be analyzed with StreamMetabolizer to get ecosystem respiration

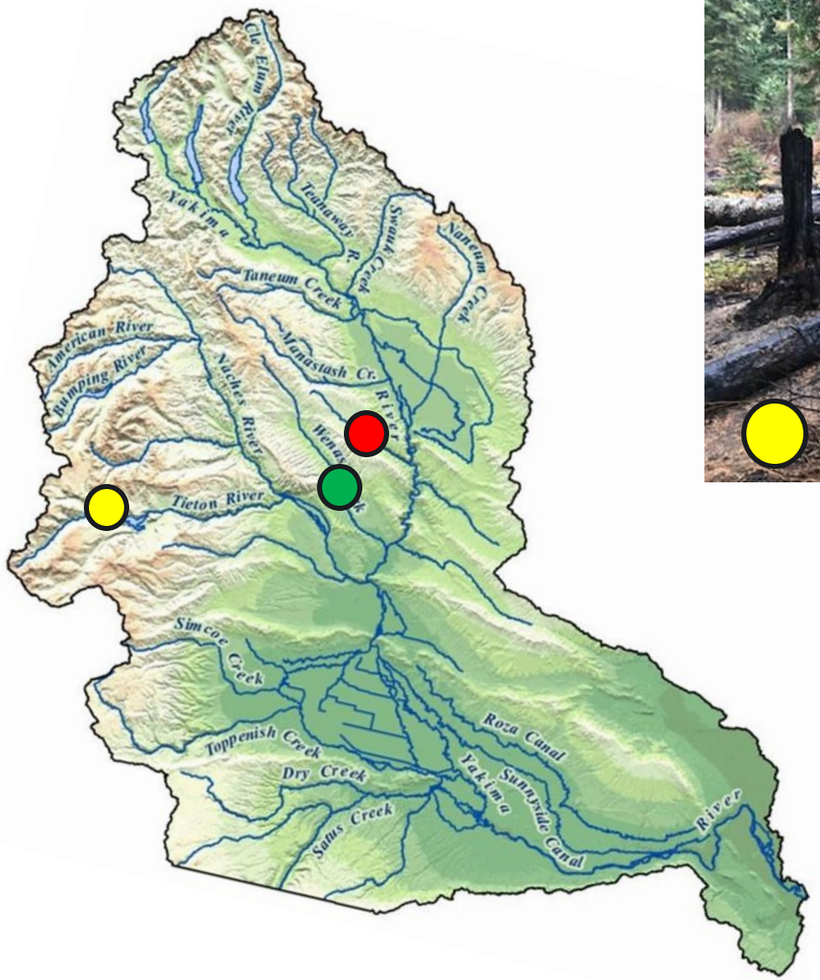
Watershed Disturbances (RC-3) Motivating Knowledge Gaps

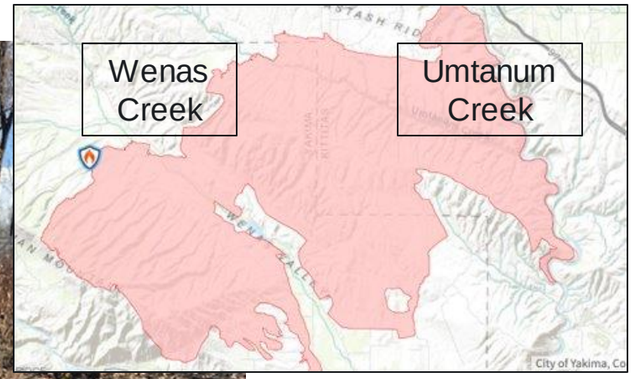
Pyrogenic inputs (PyOM, inorganic nutrients) and their impact on river corridor biogeochemistry are not well constrained.

N- and P- rich PyOM is comparatively understudied yet may be particularly bioavailable



Watershed Disturbances (RC-3) Field Sites





Watershed Disturbances (RC-3) 2021 Field Efforts

RC3-YRB Temporal Studies

- "Long term" temporal trajectories of wildfire impacts on river corridors
  - Clear Creek and Wenas Creek
  - Variations in post-fire burn impacts/severity
  - Differences in land cover, geomorphology
- Monthly water sampling for several months from within and outside the fire perimeter
- Analysis for OM composition and other WQ variables

RC2-RC3 Spatial Study Collaboration

- Relating PyOM impacts with watershed features
  - Land Cover
  - Geomorphology
  - Burn Severity
  - Time Since Fire
- RC-3 samples at some RC-2 locations and vice versa
- Planned sediment sampling campaign coordinated with RC-2 and GROW (Genome-Resolved Open Watersheds); OM and microbial community analyses

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