The Trask River Watershed Study

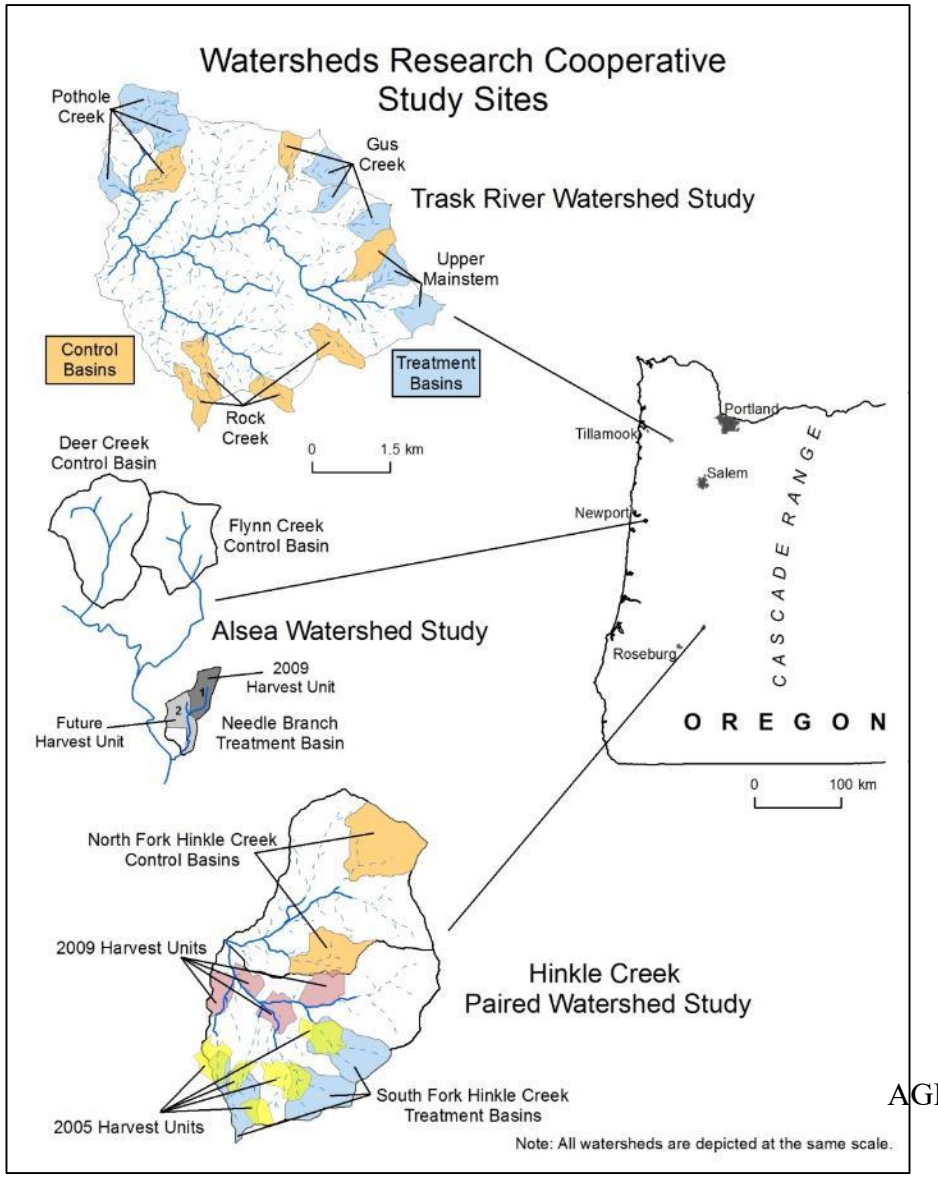
Trask River Watershed Study | Watershed Research Cooperative

Coop established in 2006 by OSU College of Forestry

Agency, industry and academic organizations participated

Goal: Quantify effects of current OR forest practices on streams

Approach: Watershed-scale experimental studies; cooperative, multi-disciplinary and long-term (decade).



Trask River Watershed Study

Funding/Research Team

- Collaborative effort-involved scientists from multiple organizations; state, federal, private

- Funding from multiple sources
  - Base funding: ODF, Weyerhaeuser
  - Infrastructure funding – OWEB
  - Fish, amphibians, birds – USGS
  - Other support – counties, OSU, USFS, BLM, NCASI

Dr. Sherri Johnson, *PNW Research, USFS*
Dr. Bob Bilby, *Weyerhaeuser Company*

Liz Dent, *Oregon Dept. of Forestry*
Dr. Jason Dunham, *USGS FRESC*
Dr. Michael Adams, *USGS FRESC*
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Maryanne Reiter, *Weyerhaeuser Company*
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Dr. Alba Argerich, *OSU College of Forestry*
Dr. Mark Meleason, *Oregon Dept. of Forestry*

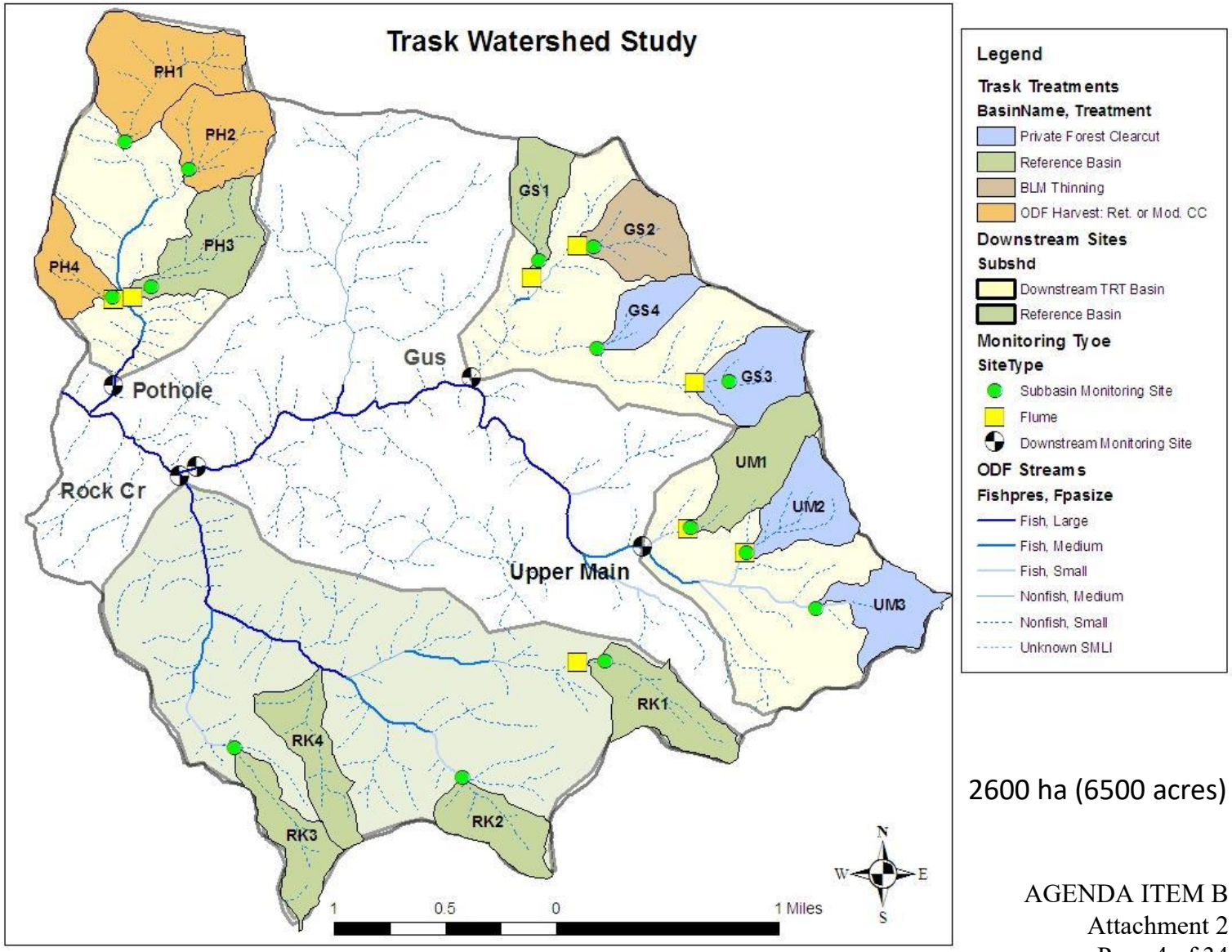
Trask River Watershed Study

Study Design

Objectives

- Quantify effects of forest harvest on the physical, chemical and biological characteristics of small, headwater streams

- Examine extent to which harvest in headwaters influences the physical, chemical and biological characteristics in downstream fish-bearing reaches



2600 ha (6500 acres)

Trask River Watershed Study

Treatment Types

Treatment Types

- Private Lands – clear-cut with no buffer (leave trees at some sites)
- State Lands – modified clear-cut or retention cut with 25ft buffers
- BLM Lands – thinning with 50ft buffers

Trask River Watershed Study

Timeline

2006-11
Baseline data collection

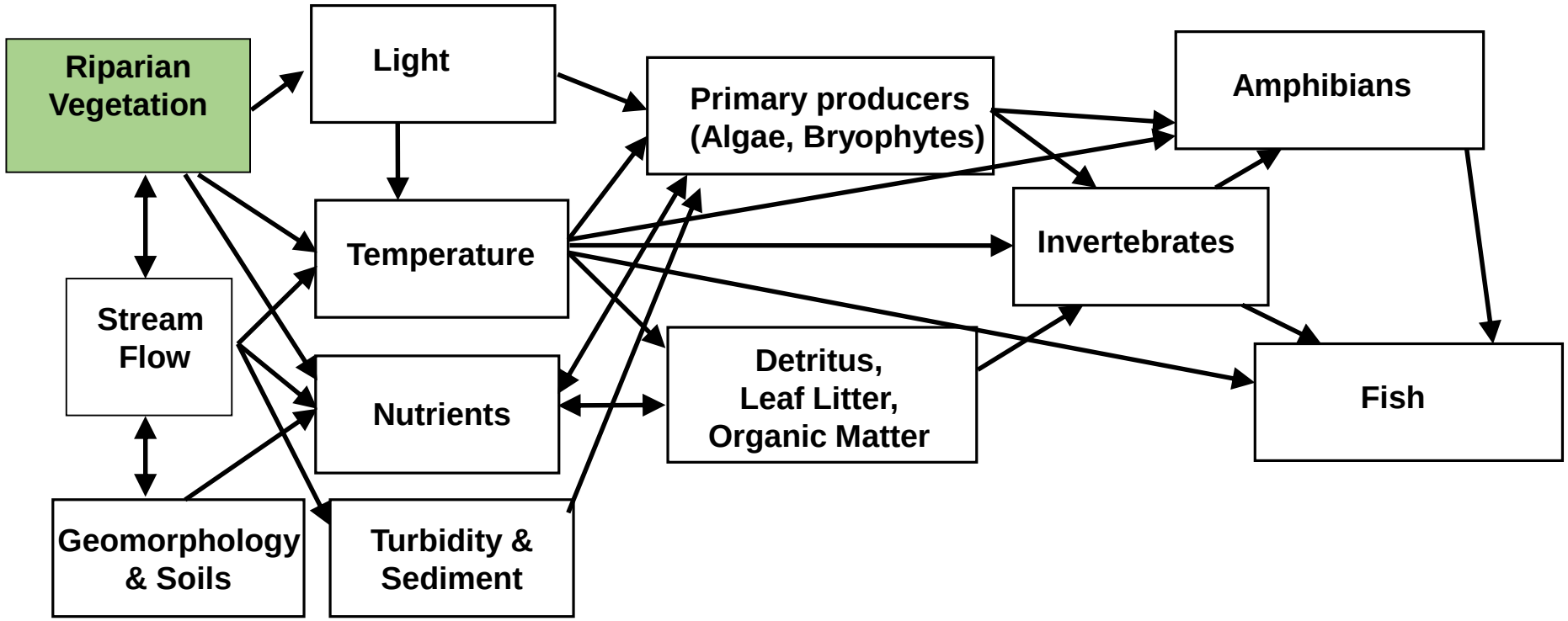
2011
Road upgrades

2012
Headwater harvest in 8 basins

2013-16
Post-treatment data collection

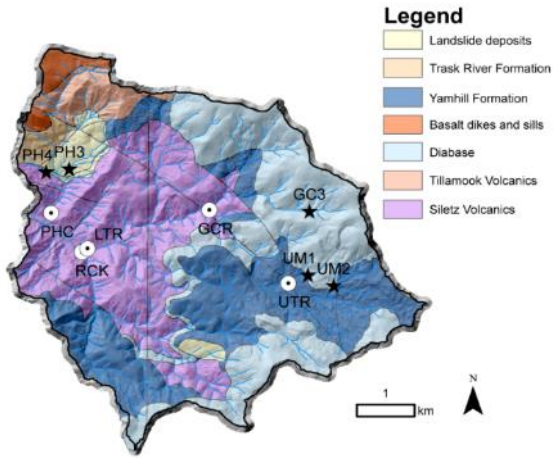
Trask River Watershed Study

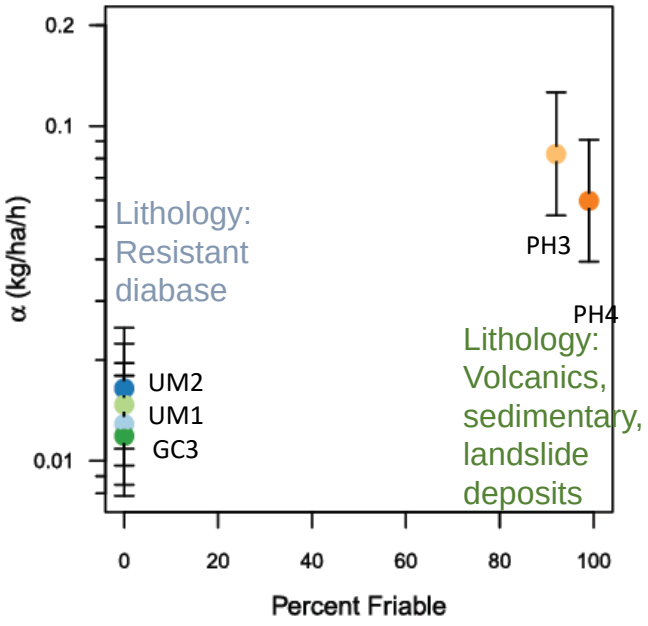
Study compartments and linkages



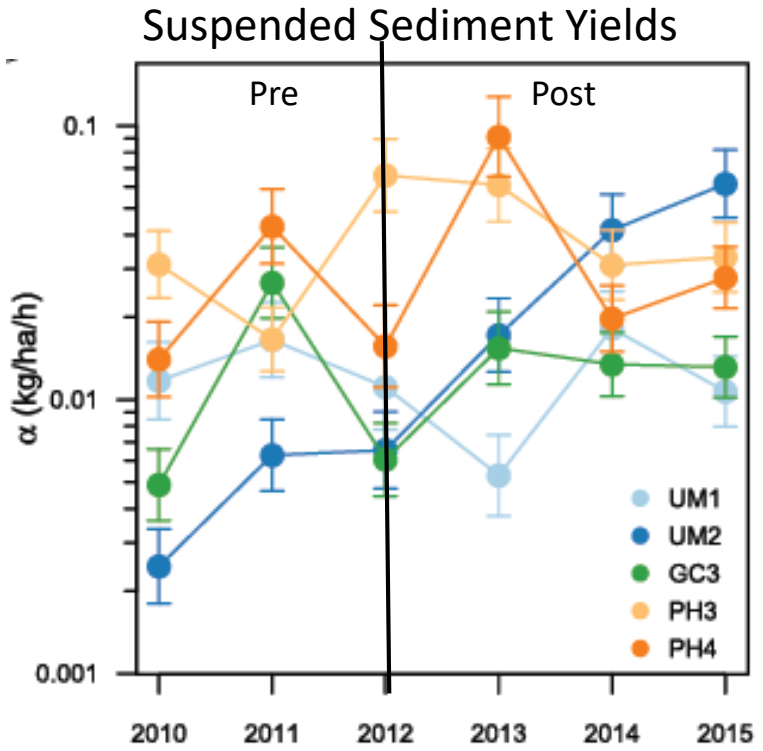
Trask River Watershed Study

Suspended sediment yields





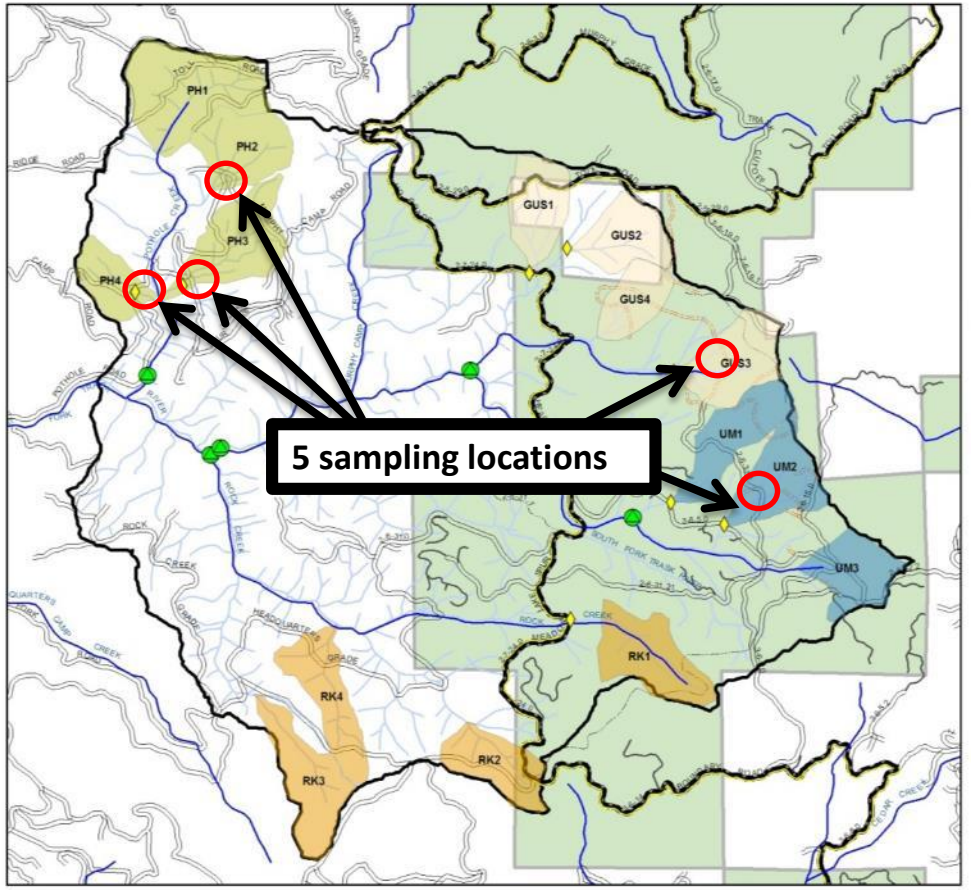
Variability in geology dominates background levels of sediment yields



Bywater-Res et al. 2017, *Journal of Hydrology*

Trask River Watershed Study

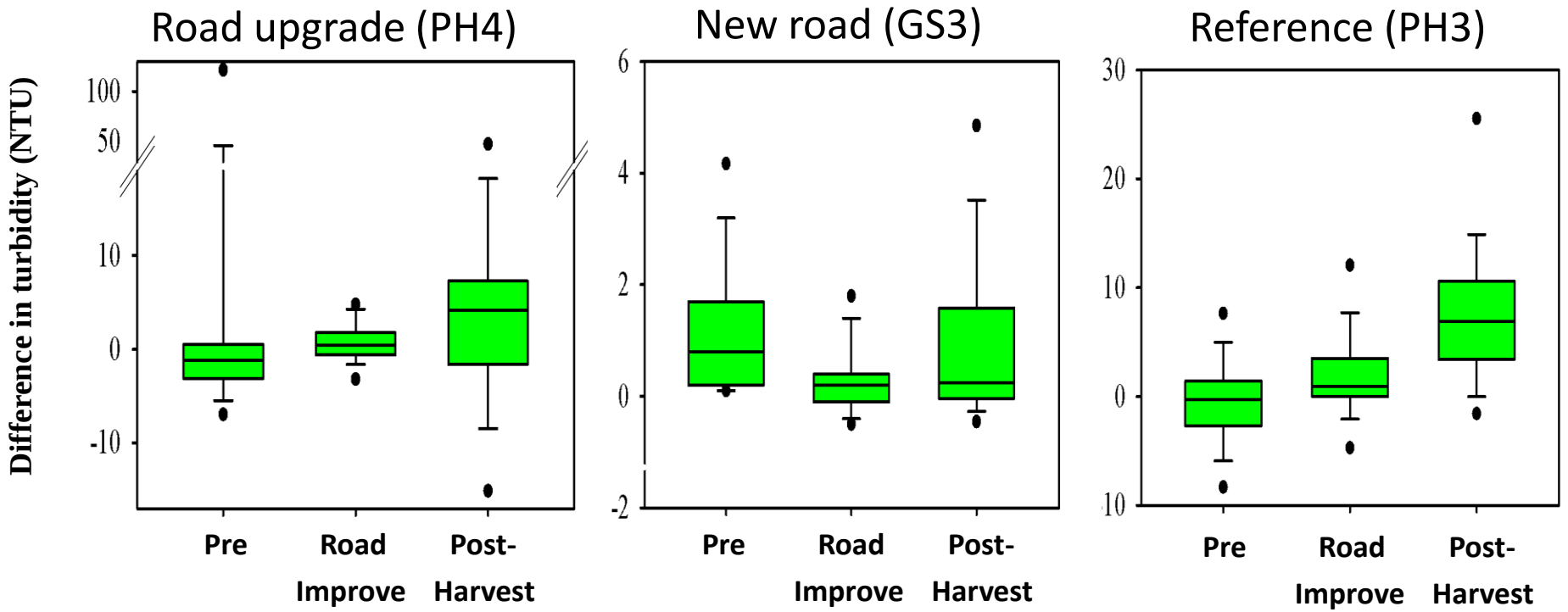
Suspended sediment above and below roads



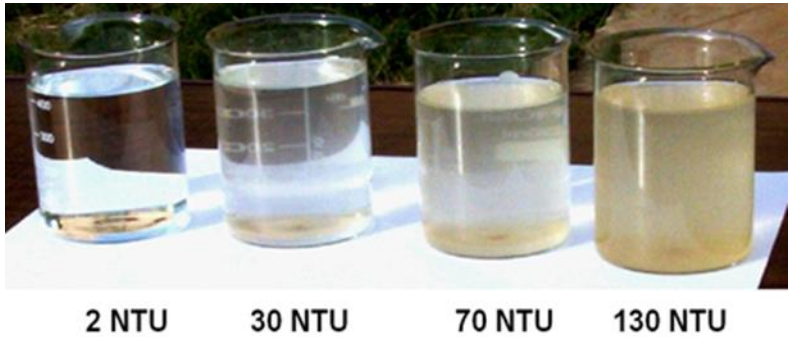
Other sites include road improvement PH2 & PH4 on State Forest and the reference site PH3.

Trask River Watershed Study

Suspended sediment above and below roads



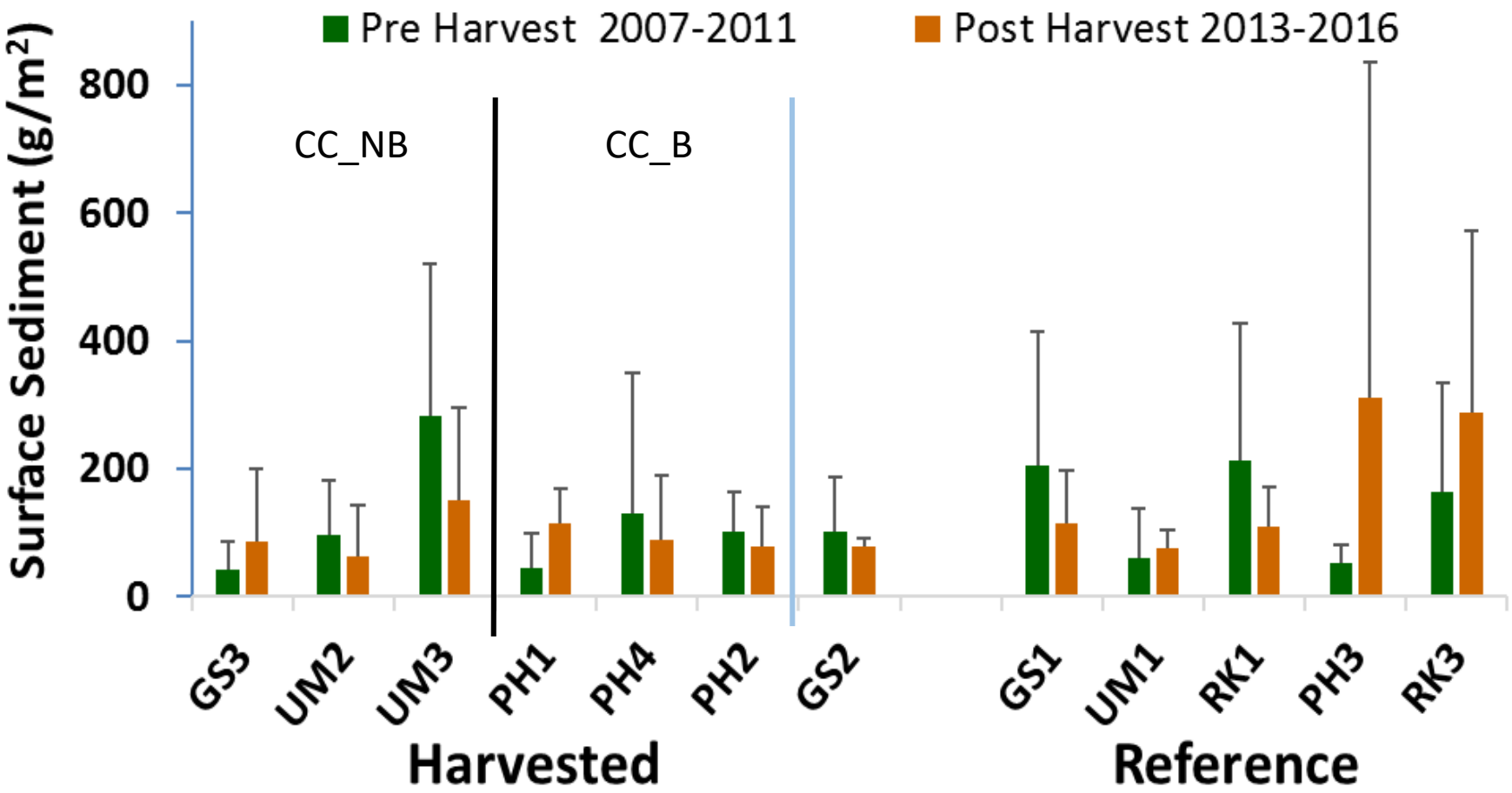
- **Minimal increases in sediment & turbidity**
- **Local disturbances important in headwaters**
- **Natural variability within/between streams**



Arismendi et al. 2017, *Water Resources Research*

Trask River Watershed Study	Instream sediment

Deposited sediment on stream beds was not higher at harvested sites



Trask River Watershed Study | Water Quality Metrics

-Clean Water Act directs EPA to set water quality guidelines for drinking water and especially where there are threatened or endangered cold water fish species

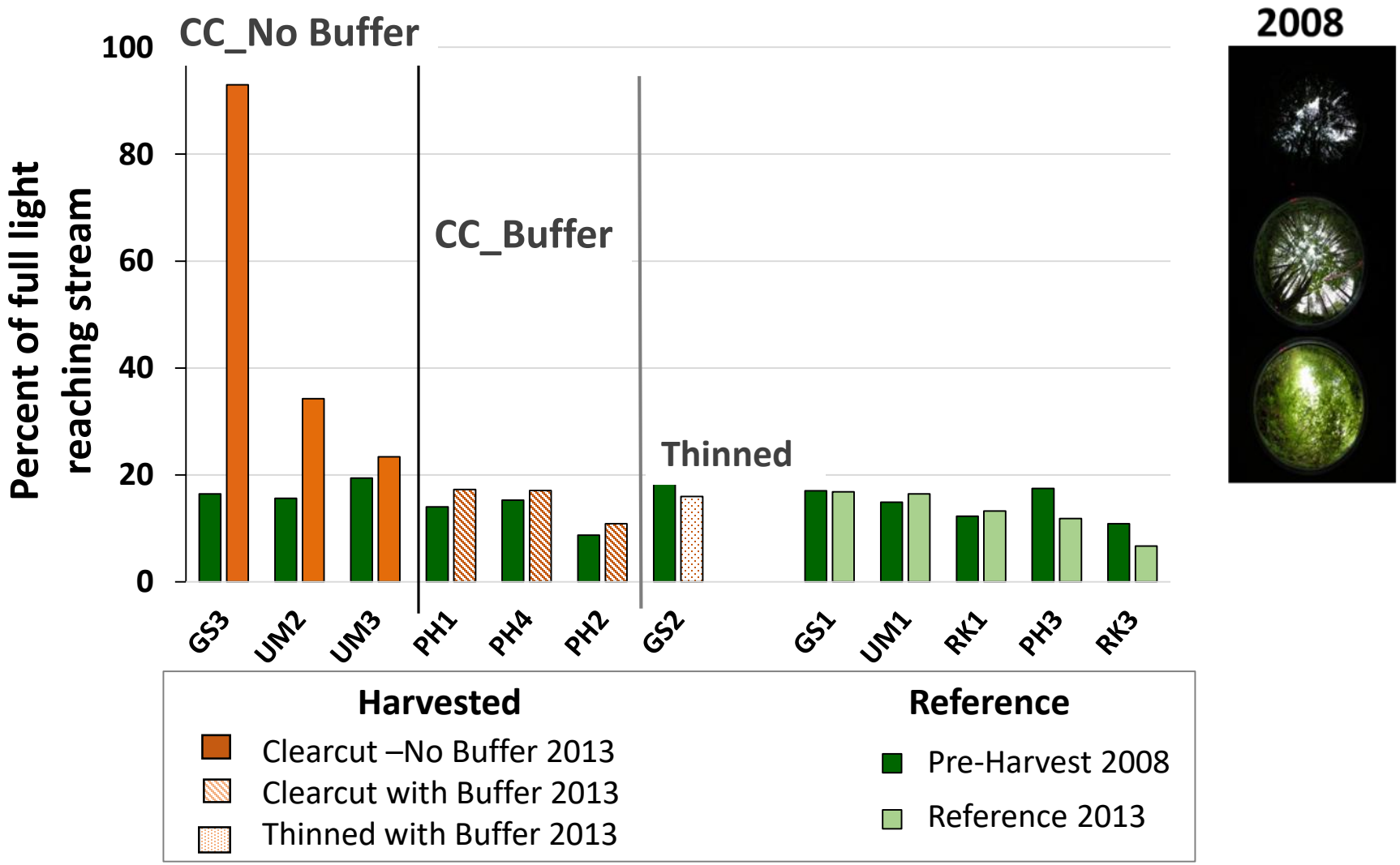
-States implement water quality regulations

- Thresholds are common water quality metric and used to quantify effects of land use change – simple to calculate, but not site specific

-Streaming data, sensor technology, and updates in computing allow us to go beyond simple thresholds and binary classifications to duration, frequency as well as magnitude

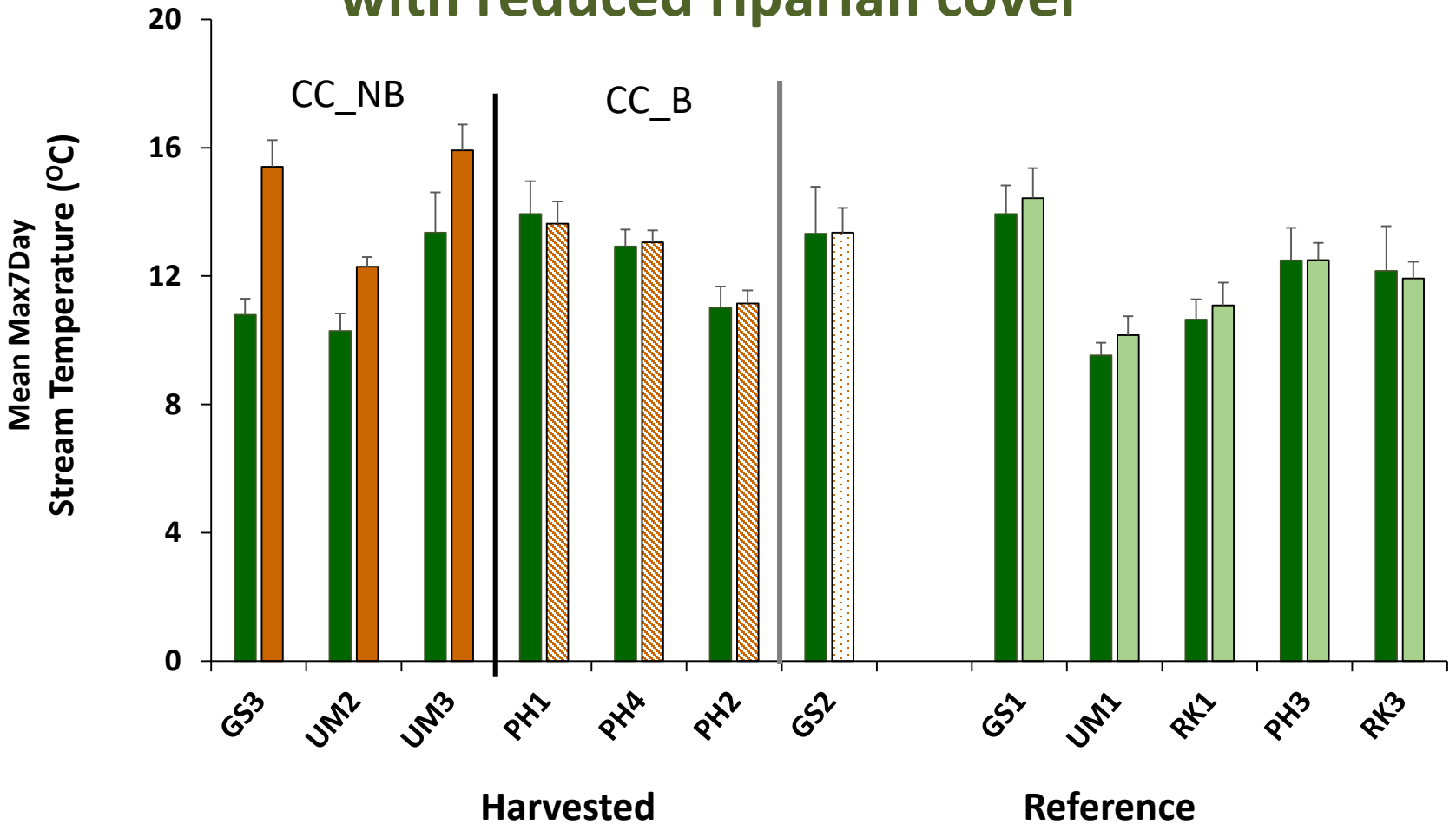
Trask River Watershed Study

Change in Light



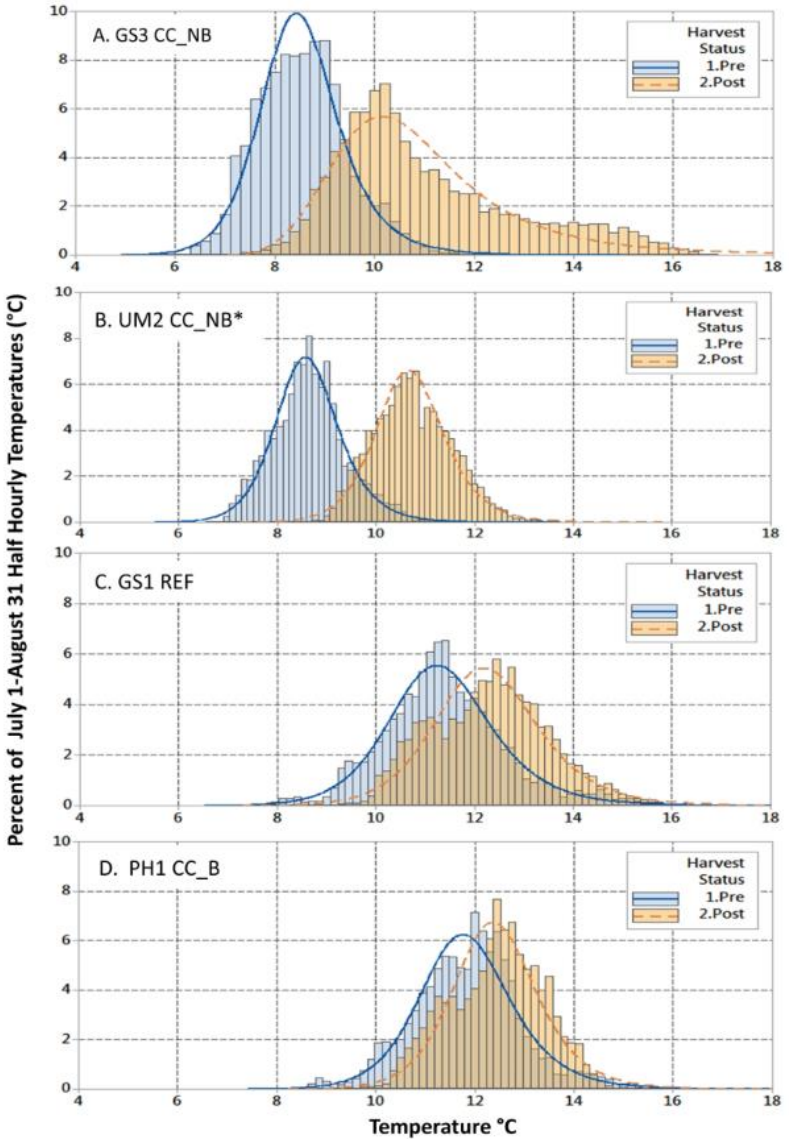
Trask River Watershed Study | Stream temperature

Increase in maximum stream temperatures at sites with reduced riparian cover



Trask River Watershed Study

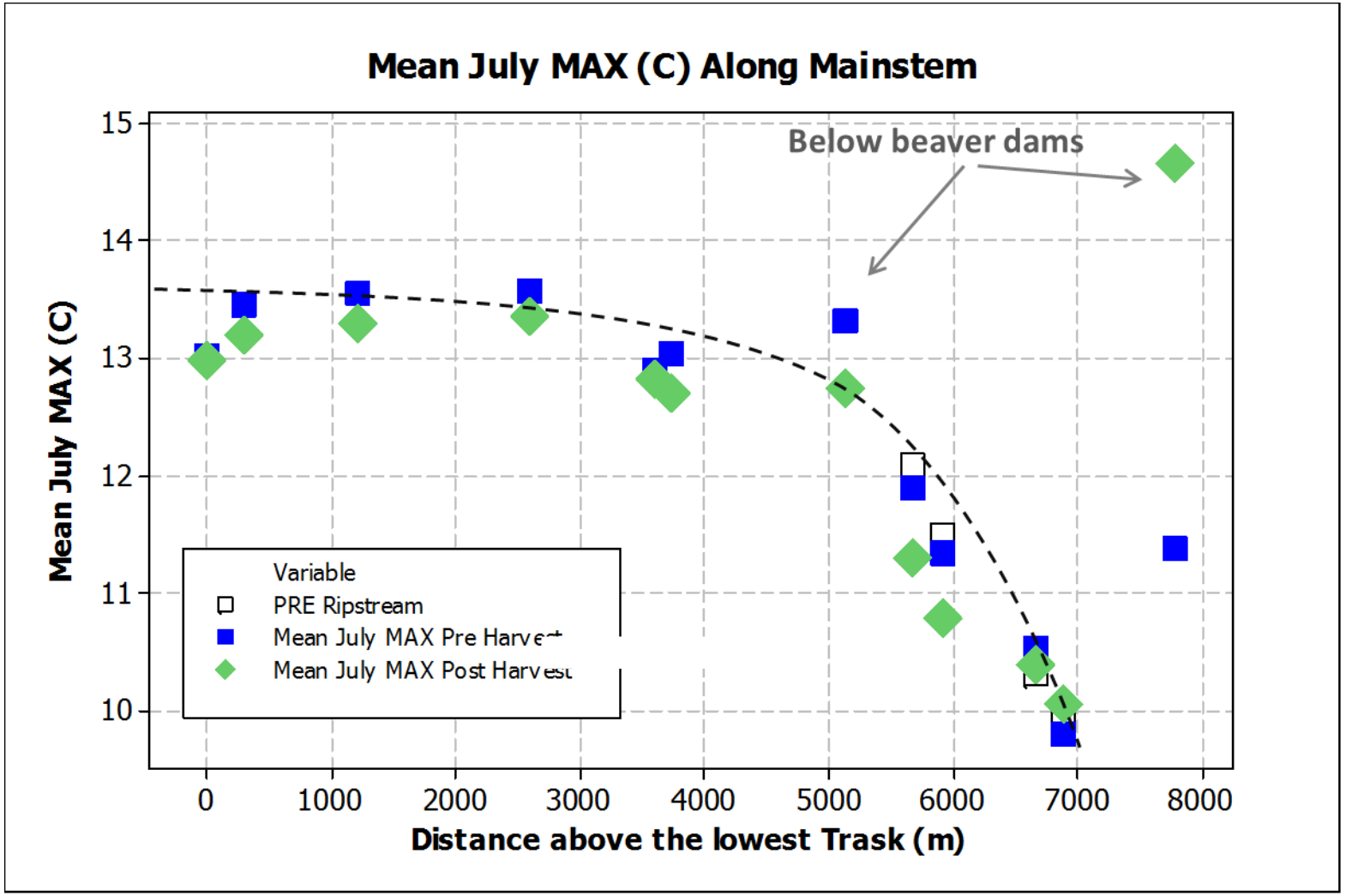
Stream temperature



A comprehensive metric would go beyond a single value for each summer and examine full distribution of temperatures that biota are exposed to.

Trask River Watershed Study

Stream Temperature



- Water temperature increases were localized – no downstream response
- Even large temperature increases (harvest and/or beaver activity) had no detectable effect downstream

Why Stream Invertebrates?

1. Good indicators of stream conditions: varied sensitivities, different life spans

2. Abundant and quickly responsive to change

Why Stream Invertebrates?

Grazers

Shredders

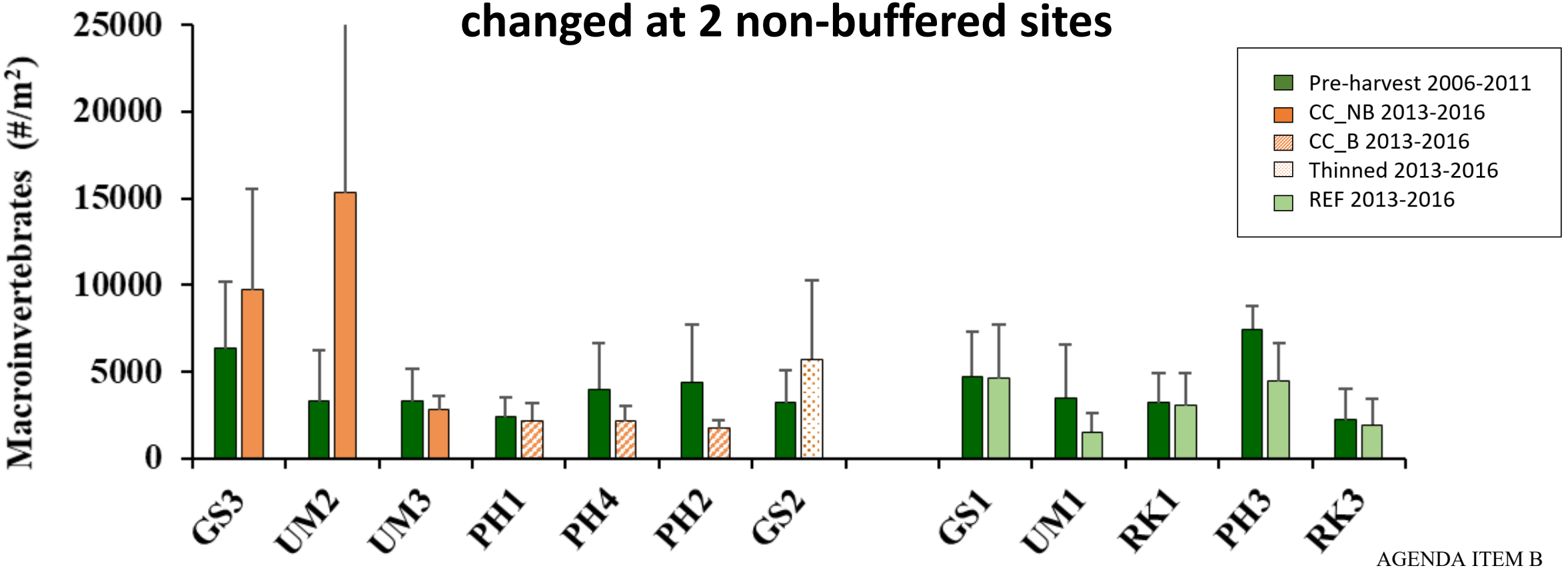
Filterers

3. Multiple functions and roles in stream food webs

Predators

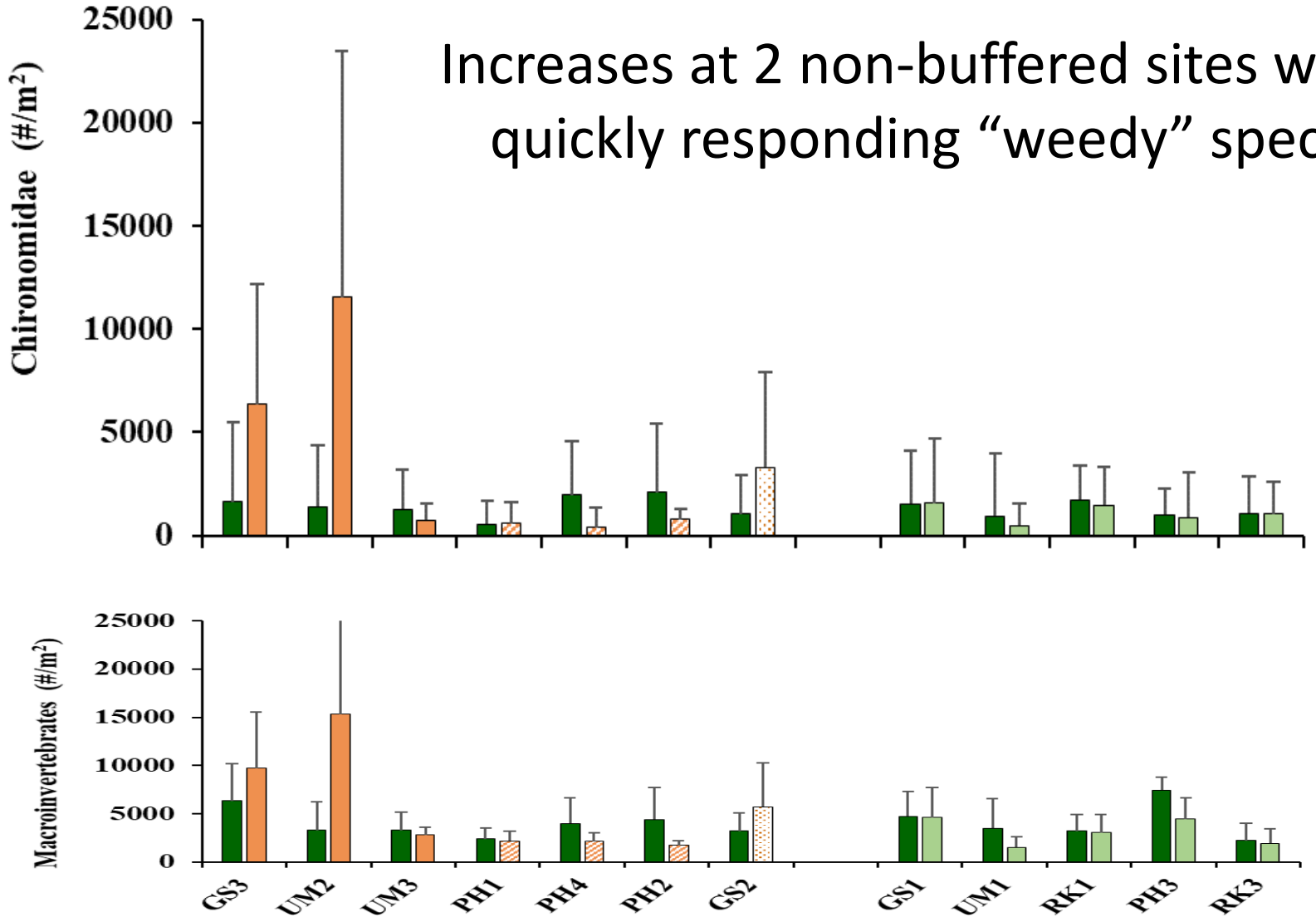
Trask River Watershed Study | Macroinvertebrates

Total abundance of invertebrates changed at 2 non-buffered sites



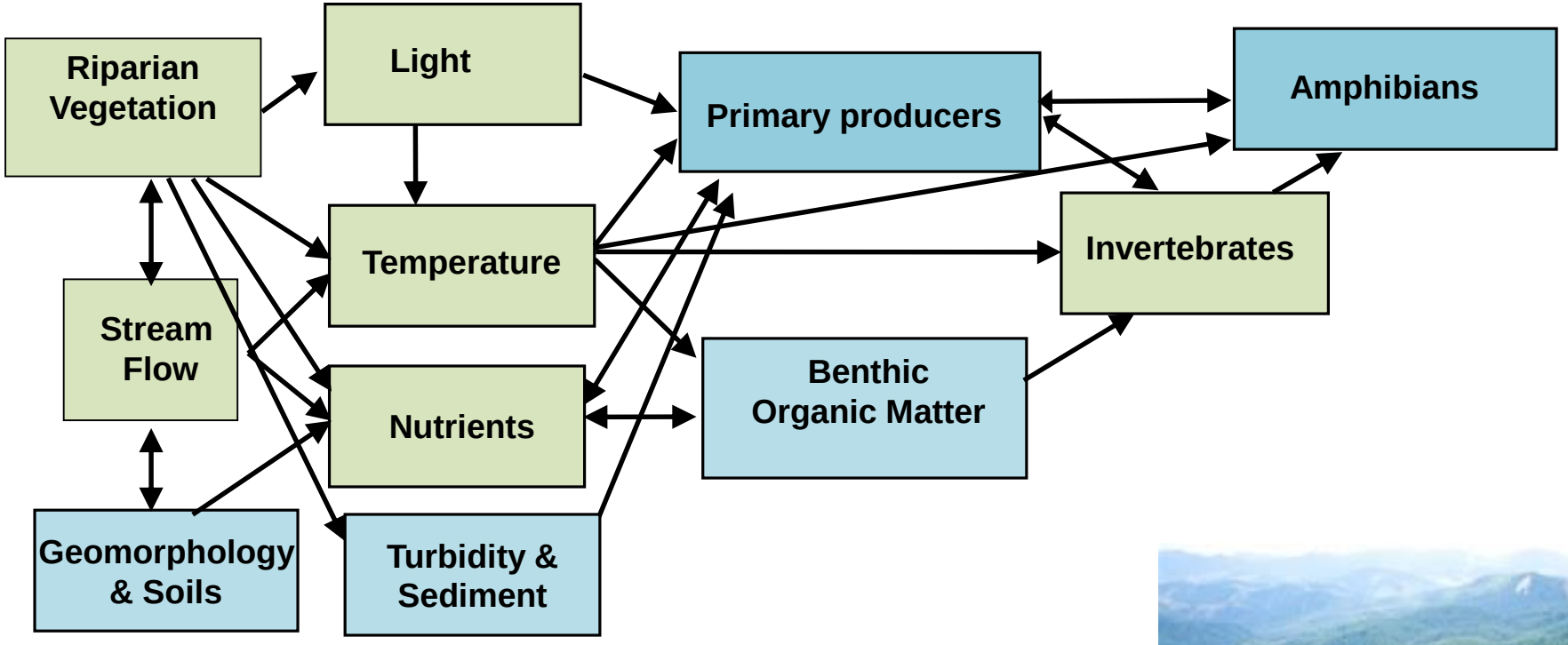
Trask River Watershed Study | Macroinvertebrates

Increases at 2 non-buffered sites were a quickly responding “weedy” species



Trask River Watershed Study

Headwater Responses: Clearcut with No Buffers

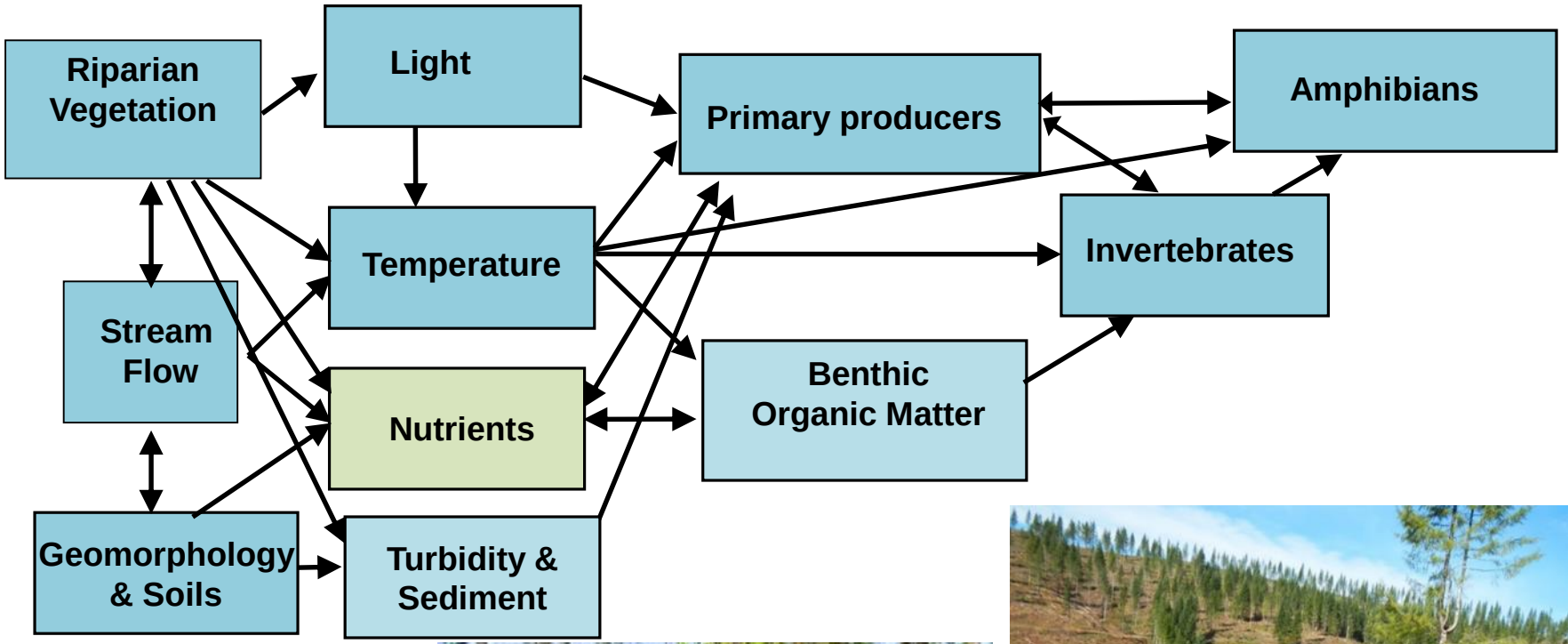


Green boxes=Change after harvest

Blue boxes= No Change

Trask River Watershed Study

Headwater Responses: Clearcut with Buffer



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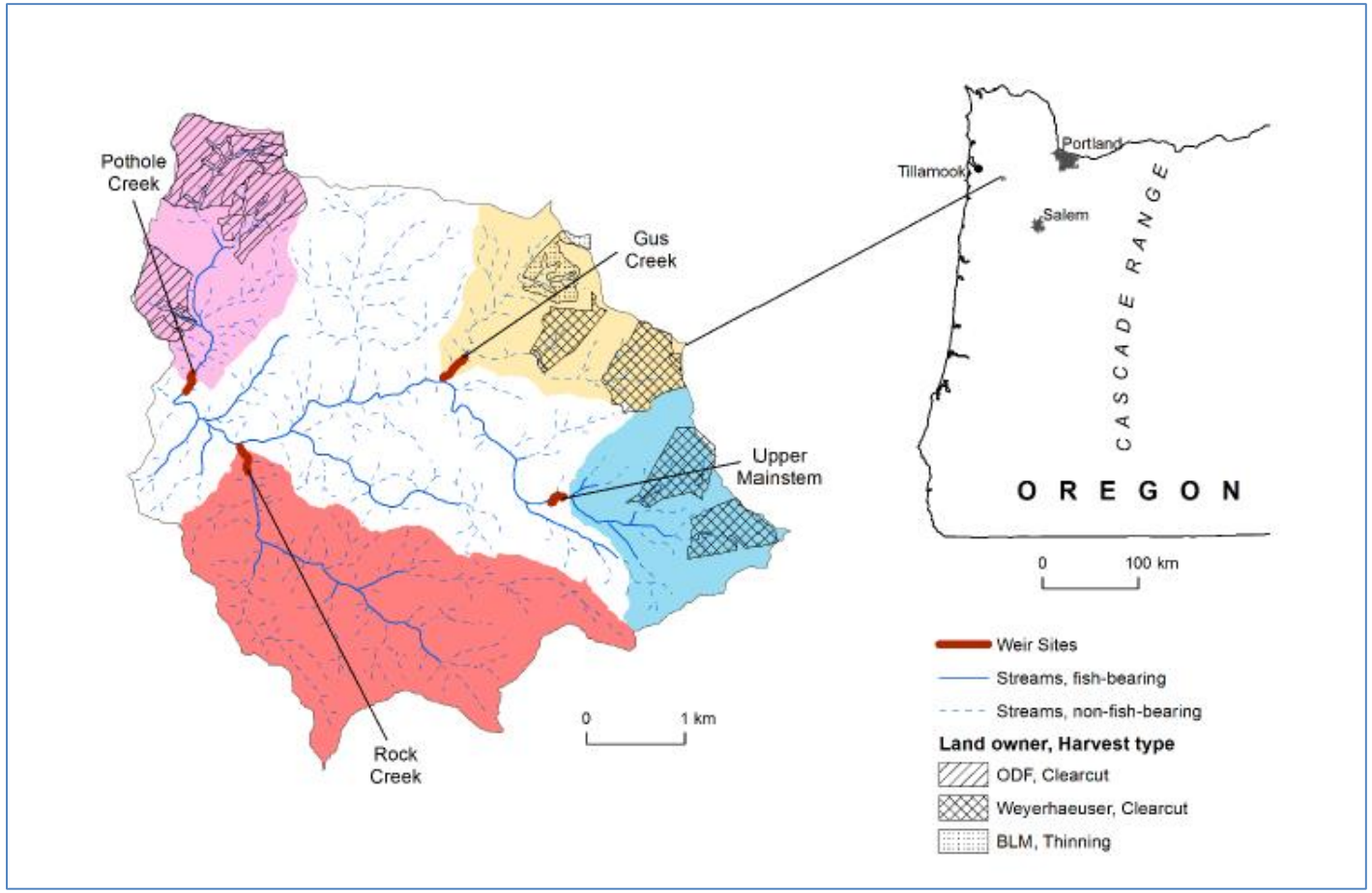
Trask River Watershed Study

Objectives

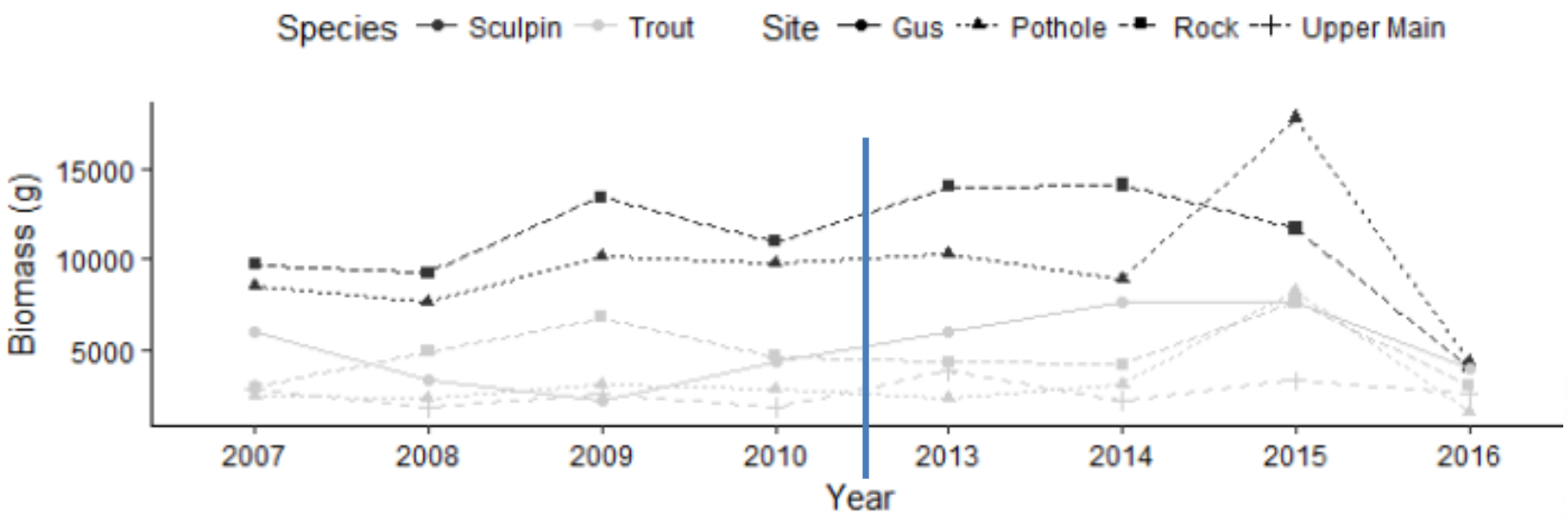


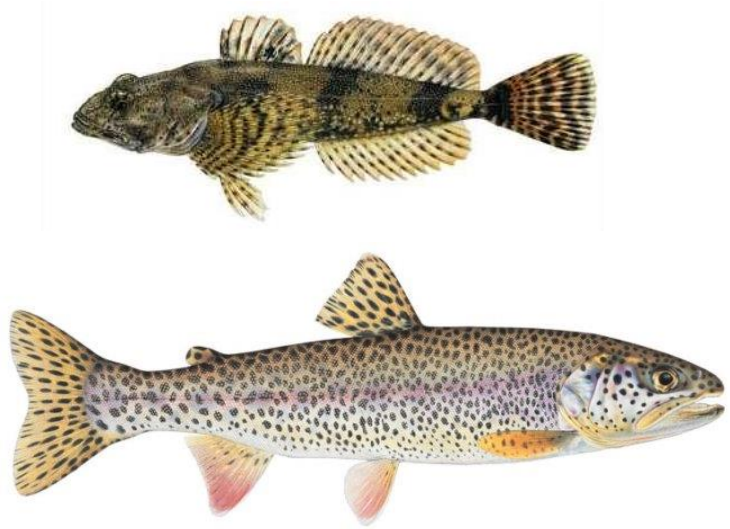
Downstream Sites:

1. Fish response in relation to upstream forest harvest
2. Fish response in relation to water temperature, stream discharge and competition

Trask River Watershed Study

Fish Biomass





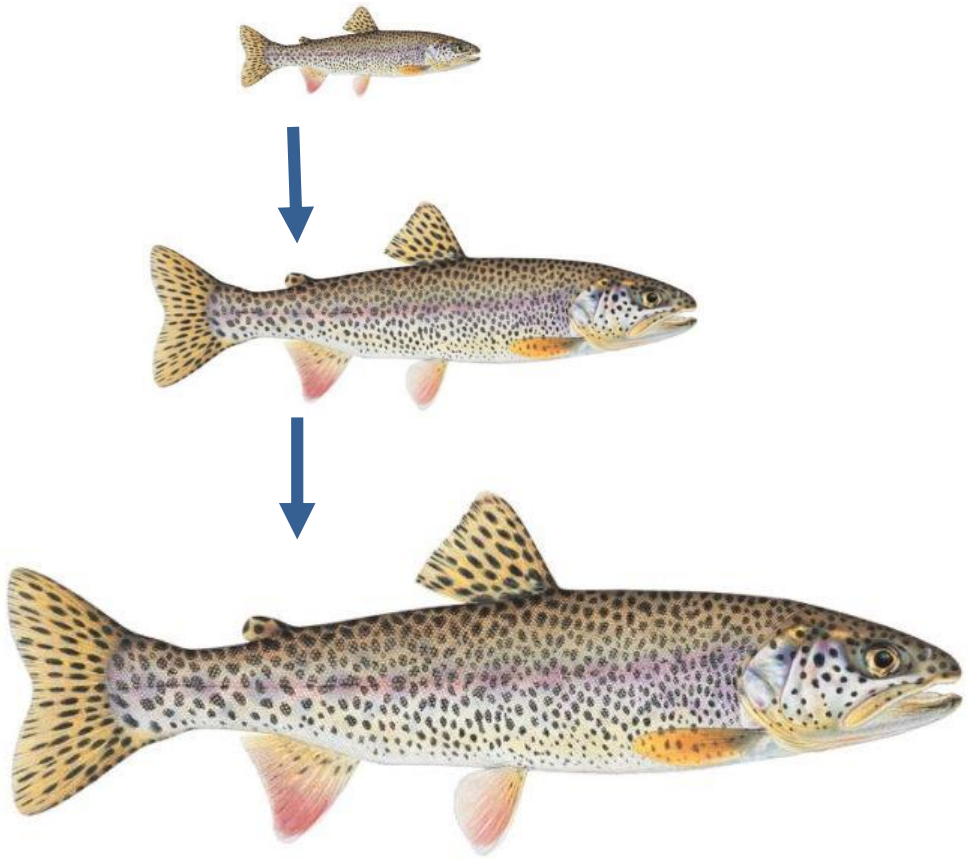
- No response to upstream harvest in either species
- Sculpin more abundant than trout
- Biomass = fish density X average weight

Jason Dunham, USGS

Why Growth?

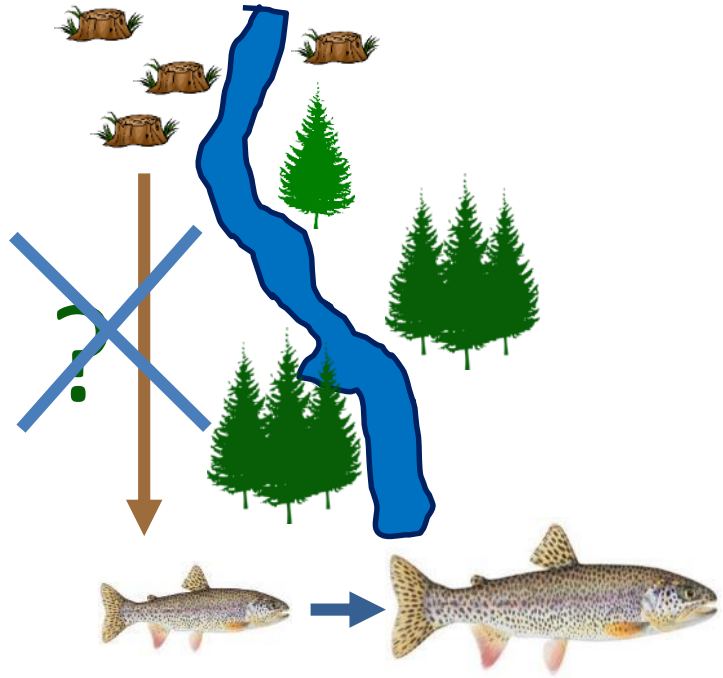
Growth

- Integrates biological processes
- Measurable in the field
- Responds quickly to environmental variability
- Key component of individual fitness



Trask River Watershed Study	**Harvest Effect**

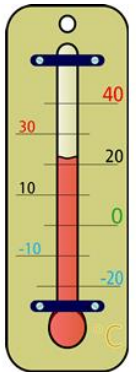
No harvest effect detected at downstream sites on fish growth



- Growth = Temperature + Discharge + Biomass + *e*
  - Temperature = mean during growth period
  - Discharge = mean during growth period
  - Biomass = biomass of conspecifics (competition)
  - *e* = random effect of stream site

Trask River Watershed Study | Temperature Variability

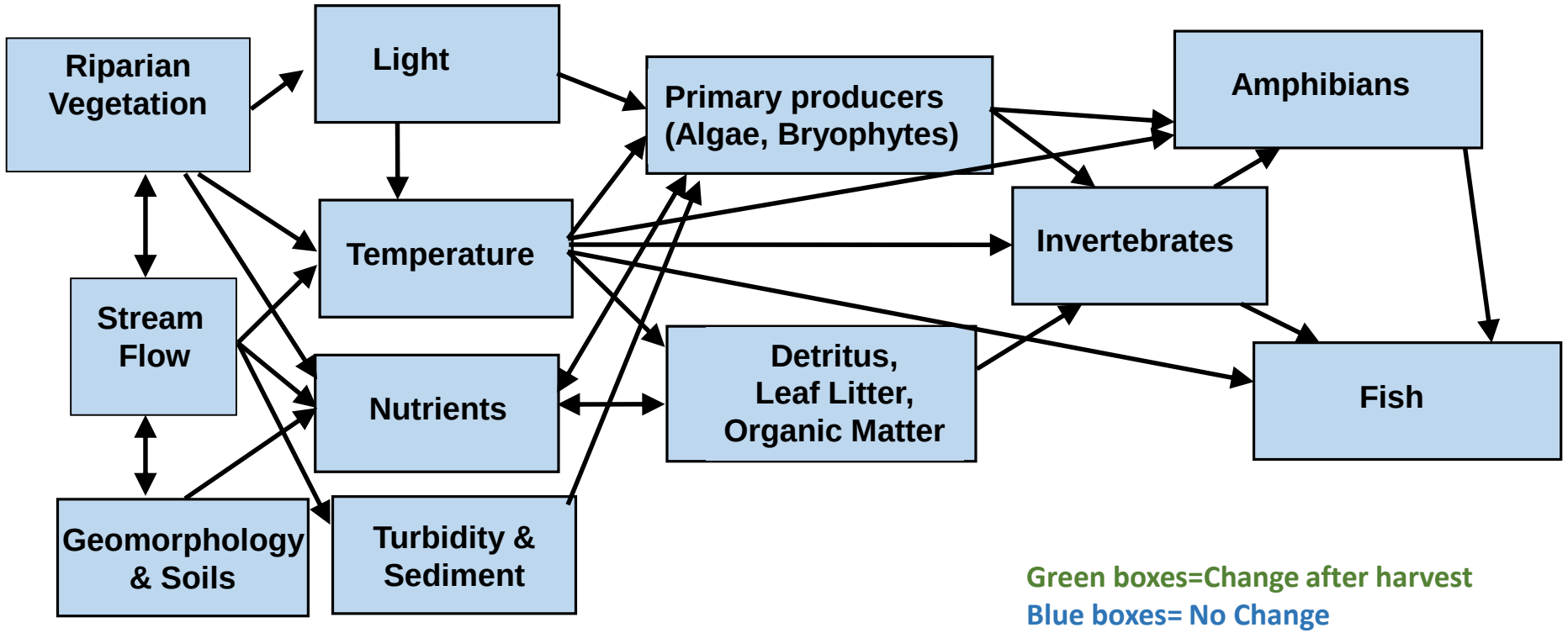
- Positive effect of water temperature on fish size and growth
  - Variation among sites in summer temperature related to growth
  - Growth rate for both trout and sculpin slightly higher at warmer sites:



- No observable relationship of growth to discharge or competition

Trask River Watershed Study

Downstream Sites



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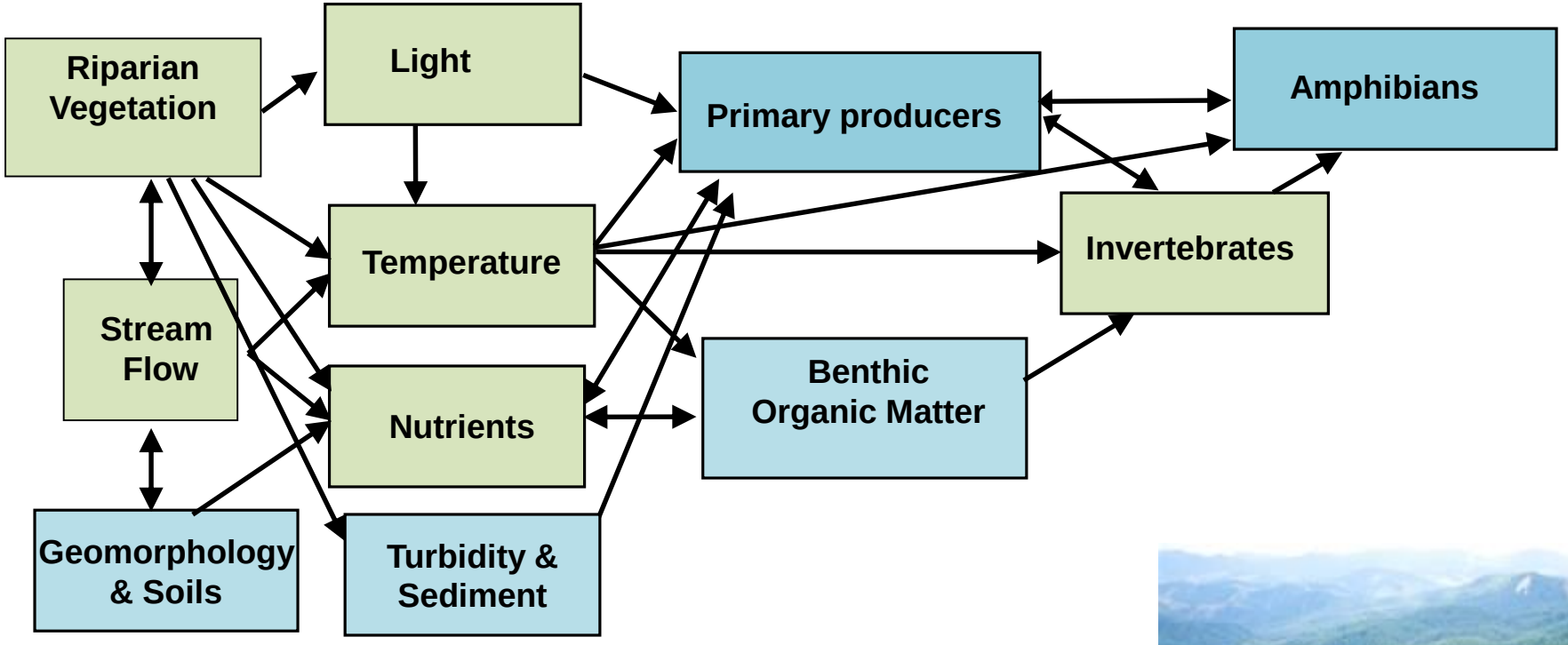
Trask River Watershed Study

Headwater Responses: Clearcut with No Buffers



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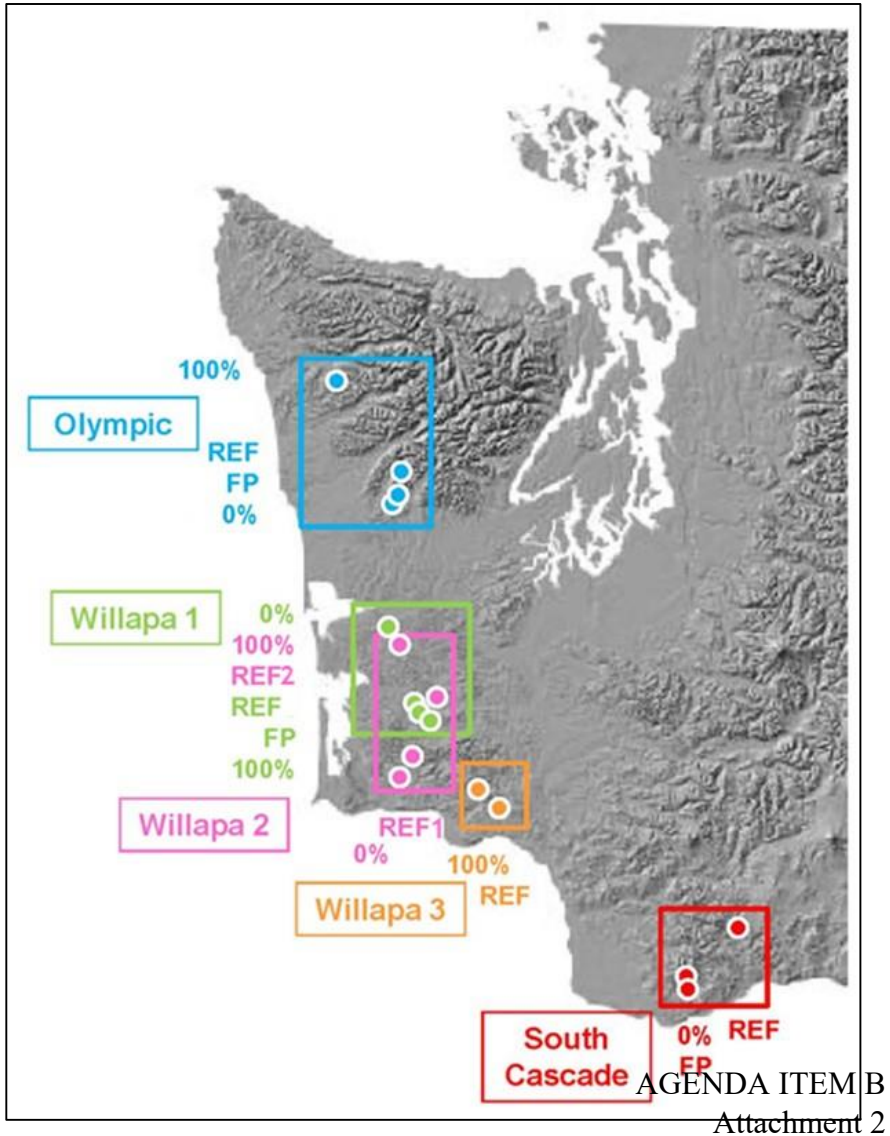
Trask River Watershed Study

Extending Results Beyond Study Sites

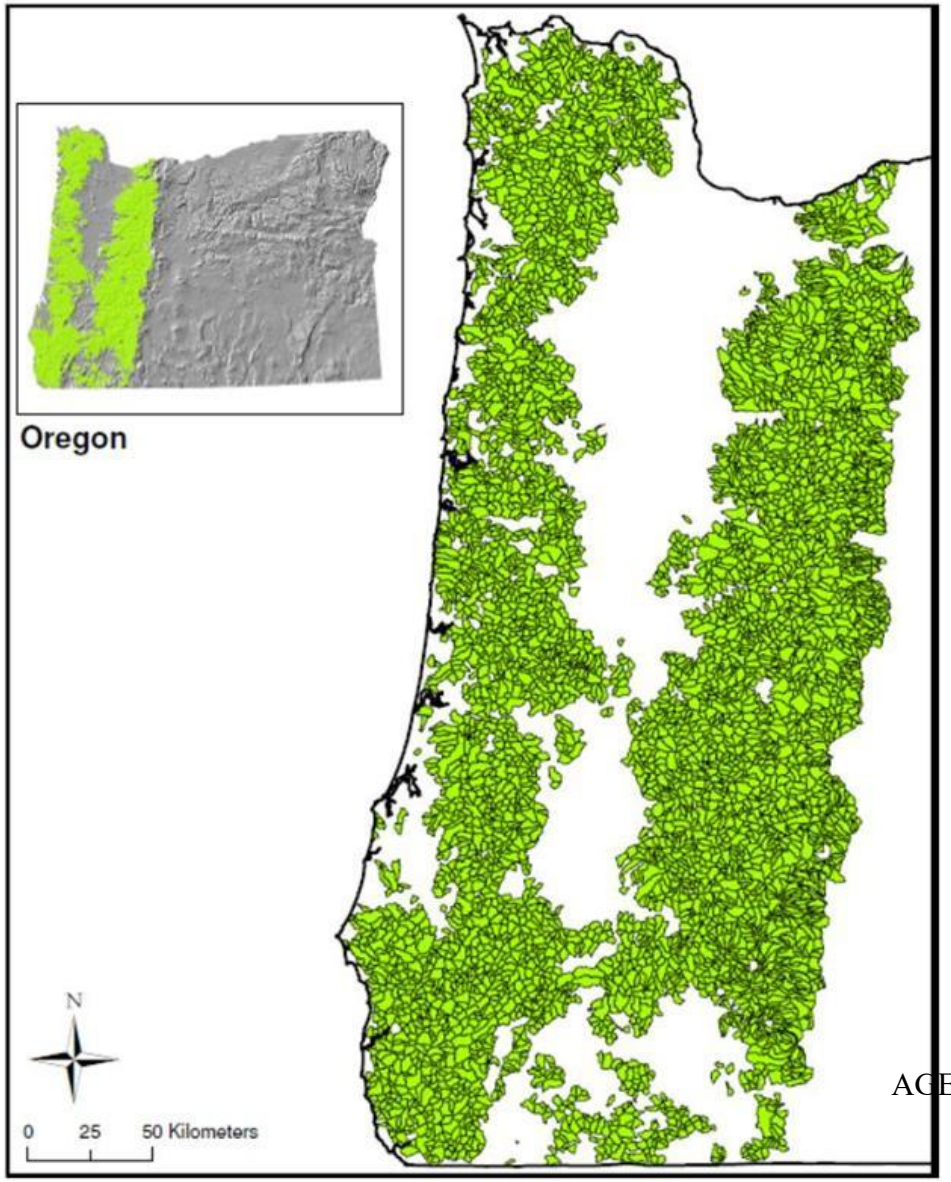
- Synthesis of results from multiple studies examining similar treatments
  - Hinkle Cr.
  - WA Type N study
- Modeling
  - Hydrology/water quality models
  - Biological models (individual-based models for fish)
- Watershed classification
  - Watersheds with physical characteristics comparable to study watersheds most likely to respond similarly



Trask River Watershed Study

Watershed Classification

- Examined forested watersheds in western Oregon
- Watershed delineation from USGS EROS (Earth Resources Observation System) data
- 5528 watersheds delineated – about 2 sq. mi. each
- Characterized using multiple features
  - Climate
  - Land use
  - Vegetation cover
  - Geology
  - Topography
- Calculated relative similarity to the WRC watersheds determined



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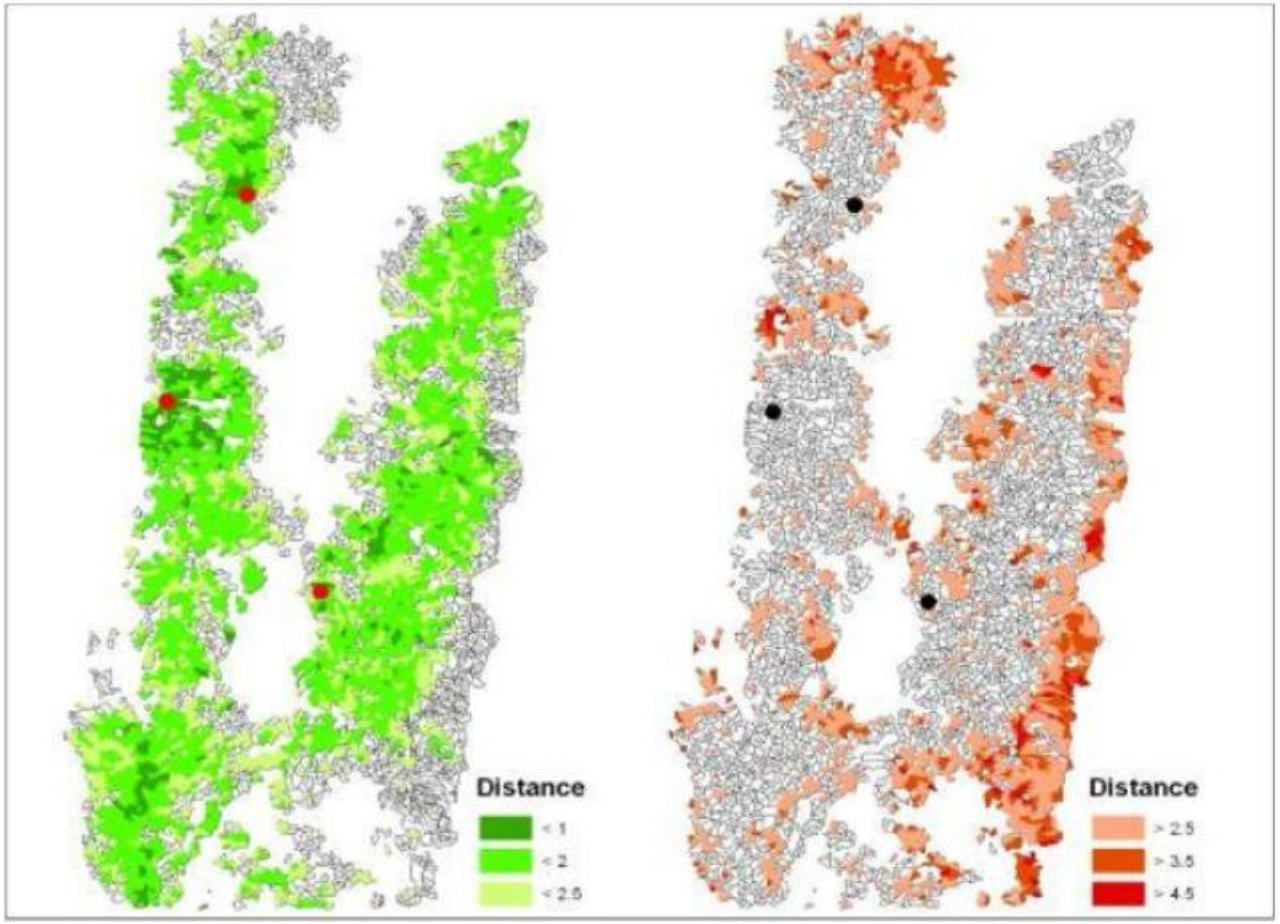
Similarity Results



	HA < 2.5	% Landscape	# of Basins
Trask	1915568	39.4	2117
Hinkle	2120057	43.6	2385
Alsea	2319306	47.7	2534
All WRC Basins	3215564	66.2	2796

Trask River Watershed Study

Applying Science to WP

- Limitations of scientific studies
  - Rarely consider social, economic or political drivers
  - Uncertainty in science
  - System response varies spatially
  - Dueling science – Ripstream example
  - Address one question at a time – policy issues often involve of multiple factors
  - Some policy issues may lack, or have limited, relevant scientific finding
  - Apply study results with appreciation of limitations
- Make better use of existing science
  - Synthesize research results – compile and interpret science in a manner aligned with key policy questions

Trask River Watershed Study