

Puget Lowland Ecoregion Streams Status & Trends

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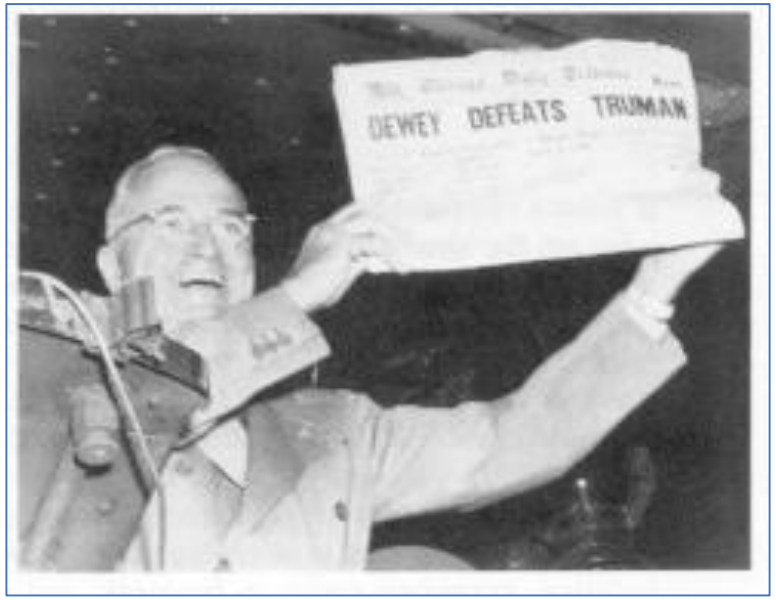
Study questions:

- **Q1:** What percent of streams meet biological, water, and sediment quality standards for beneficial uses within and outside urban growth areas (UGAs)?
- **Q2 & Q3:** What natural and human variables correlate with the status of streams within and outside the UGA?
- **Q4:** How do SAM results compare to other monitoring programs in Puget Sound?
- **Q5:** What parameters would be carried forward for trend assessment of SAM stream monitoring in the future, and at what timing and frequency?

Sampling design “survey-based”

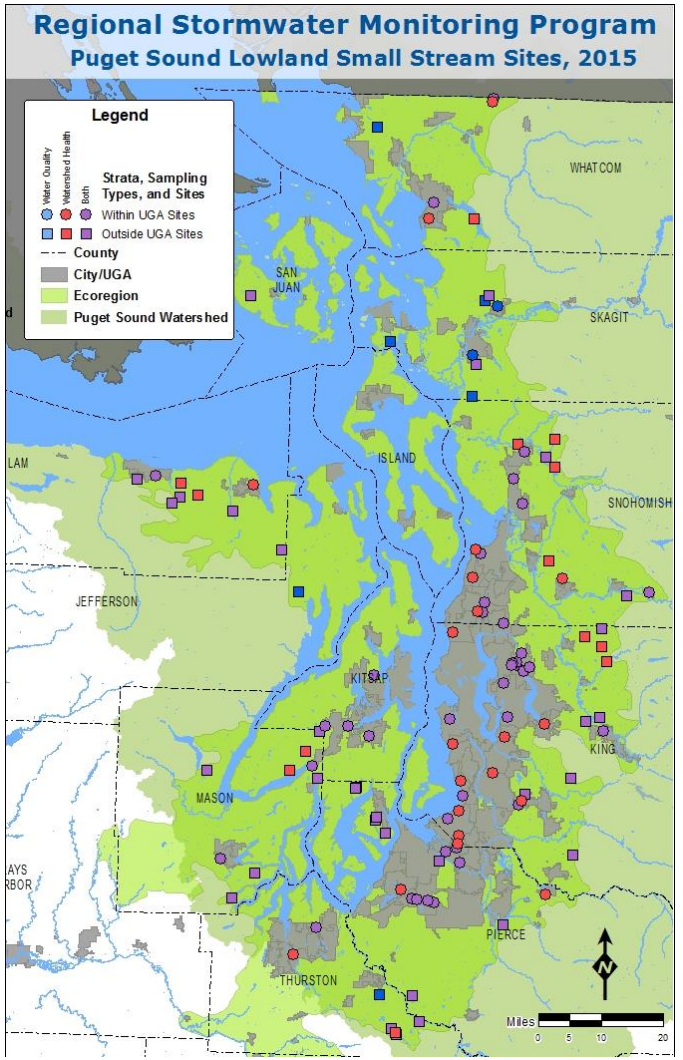
- Analogous to polling methods
- A complete census is not possible
- Survey-based sampling is efficient
- Survey-based sampling provides confidence bounds on results

We avoided this:



Sampled small Puget Lowland Streams within and outside urban growth areas (UGAs) for:

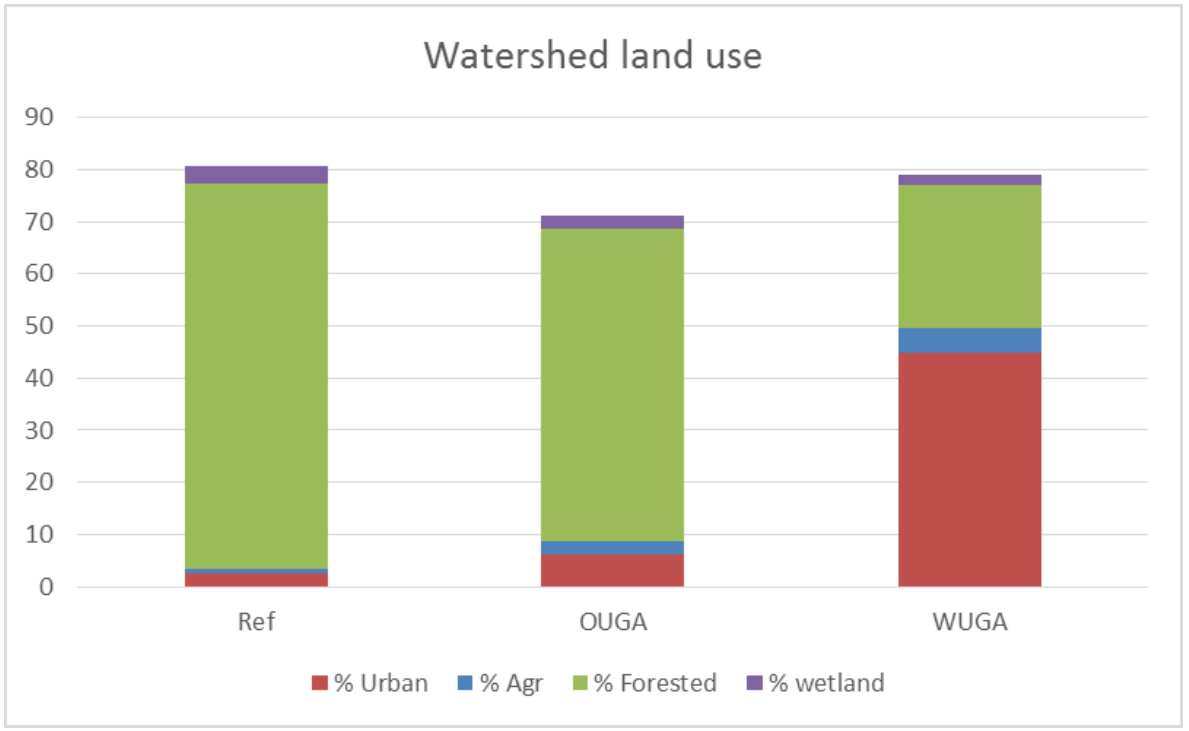
- Monthly water quality Jan-Dec 2015
  - Conventional parameters, metals, PAHs, stream flow
- Summer Watershed Health Monitoring
  - Water quality (conventional parameters)
  - Benthic macroinvertebrates
  - Periphyton
  - Sediment chemistry (TOC, metals, phthalates, PAHs, PCBs, PBDEs, common pesticides)

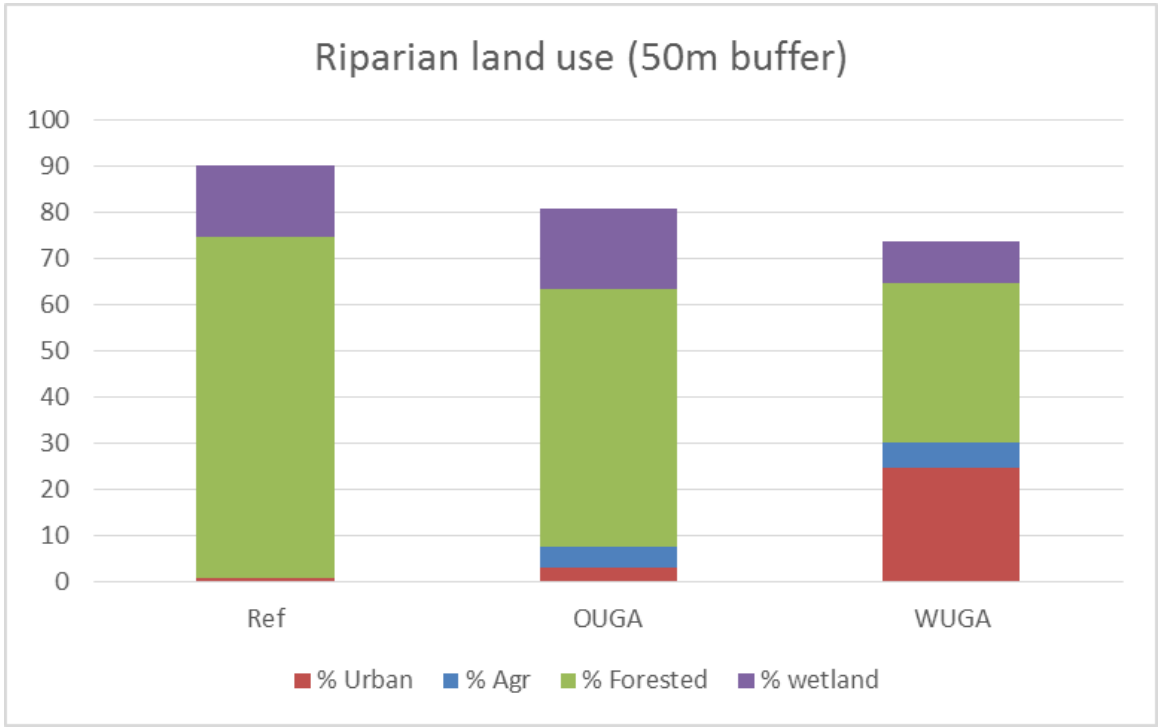


Included watershed and riparian GIS analysis

- Leveraged USGS NAWQA expertise (and USGS $) to derive land cover and other landscape parameters for all SAM PLES sites and 16 least-disturbed reference sites
- Why? Because local riparian and upstream land cover shown to be important factor for biological communities

Land cover summary within and outside UGAs





SAM Stormwater Action Monitoring

Detected >50% of time	A
Detected 20-50% of time	B
Detected <20% of time	C

Receiving Waters

Water Quality ----------

Parameter	Detection Freqency	
	Outside UGA	Within UGA
Ammonia	B	B
Arsenic	A	A
Arsenic dissolved	A	A
Chloride	A	A
Chromium	A	A
Chromium dissolved	B	B
Copper	A	A
Copper dissolved	A	A
Dissolved Organic Carbon	A	A
Fecal coliform	A	A
Hardness as CaCO3	A	A
Nitrite-Nitrate	A	A
Ortho-phosphate	A	A
Total Nitrogen	A	A
Total Phosphorus	A	A
Total Suspended Solids	A	A
Lead	B	B

Parameter	Detection Freqency	
	Outside UGA	Within UGA
Naphthalene	C	C
Zinc	C	C
Zinc dissolved	C	C
1-Methylnaphthalene	C	C
2-Methylnaphthalene	C	C
Acenaphthene	C	C
Acenaphthylene	C	C
Anthracene	C	C
Benz(a)anthracene	C	C
Benzo(a)pyrene	C	C
Benzo(b)fluoranthene	C	C
Benzo(g,h,i)perylene	C	C
Benzo(k)fluoranthene	C	C
Benzofluoranthenes, Total	C	C
Cadmium	C	C
Cadmium dissolved	C	C
Carbazole	C	C
Chrysene	C	C
Dibenzo(a,h)anthracene	C	C
Dibenzofuran	C	C
Fluoranthene	C	C
Fluorene	C	C
Indeno(1,2,3-cd)pyrene	C	C
Lead dissolved	C	C
PCN-002	C	C
Phenanthrene	C	C
Pyrene	C	C
Retene	C	C
Silver	C	C
Silver dissolved	C	C
Total Benzofluoranthenes	C	C

Sediment Quality ----------

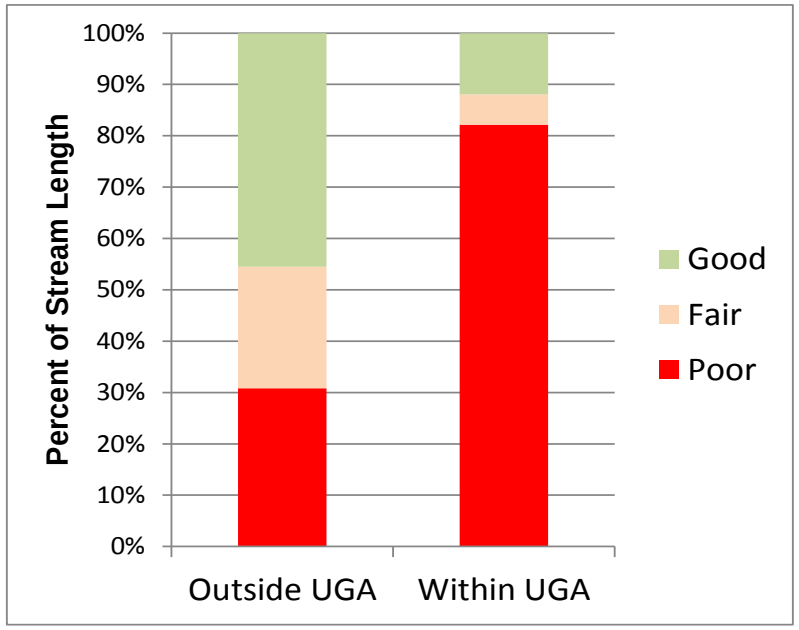
Parameter	Detection Frequency	
	Outside UGA	Within UGA
Arsenic	A	A
Cadmium	A	A
Chromium	A	A
Copper	A	A
Dichlobenil	A	A
Lead	A	A
Retene	A	A
Total PBDE	A	A
Total PCB	A	A
Zinc	A	A
Bis(2-Ethylhexyl) Phthalate	B	A
Silver	B	A

Parameter	Detection Frequency	
	Outside UGA	Within UGA
1-Methylnaphthalene	C	C
2,4-D	C	C
2-Methylnaphthalene	C	C
Acenaphthene	C	C
Acenaphthylene	C	C
Anthracene	C	B
Benz(a)anthracene	C	B
Benzo(a)pyrene	C	B
Benzo(b)fluoranthene	C	B
Benzo(g,h,i)perylene	C	B
Benzo(k)fluoranthene	C	B
Benzofluoranthenes, Total	C	A
Butyl benzyl phthalate	C	C
Carbaryl	C	C
Carbazole	C	C
Chlorpyrifos	C	C
Chrysene	C	A
DCPMU	C	C
Dibenzo(a,h)anthracene	C	C
Dibenzofuran	C	C
Dibutyl phthalate	C	C
Diethyl phthalate	C	C
Dimethyl phthalate	C	C
Di-N-Octyl Phthalate	C	C
Diuron	C	C
Fluoranthene	C	A
Fluorene	C	C
Indeno(1,2,3-cd)pyrene	C	B
Naphthalene	C	C
PCN-002	C	C
Phenanthrene	C	B
Pyrene	C	A
Total Benzofluoranthenes	C	B
Total PAH	C	A
Triclopyr	C	C

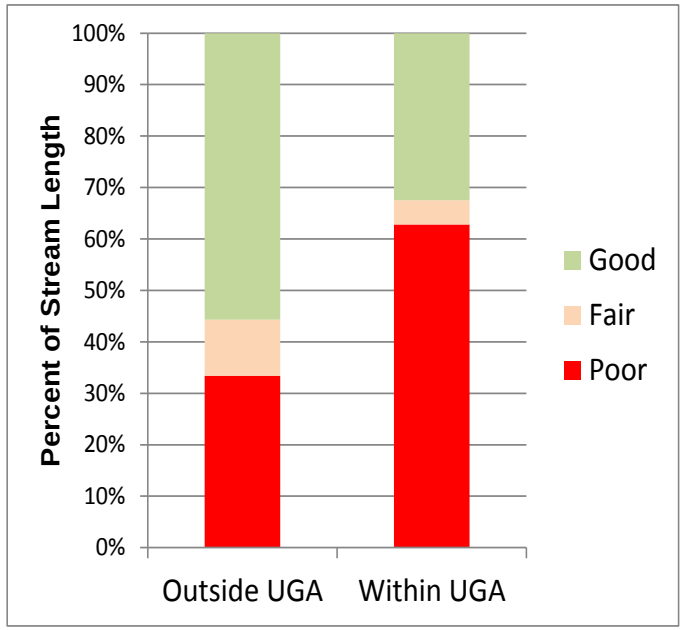
Q1: Biological Status

- Biological condition was generally worse in small streams within UGAs compared to streams outside UGAs

Benthic Index of Biotic Integrity



Trophic Diatom Index



Q1: Comparison to water quality standards

- Higher frequency of exceedance of fecal coliform standard at sites within UGAs
- Similar frequency of exceedance of temperature, pH, and dissolved oxygen standards at sites within and outside of UGAs
- Measured metals concentrations did not typically exceed relevant acute or chronic standards for the protection of aquatic life.

Q1: Comparison to sediment quality standards

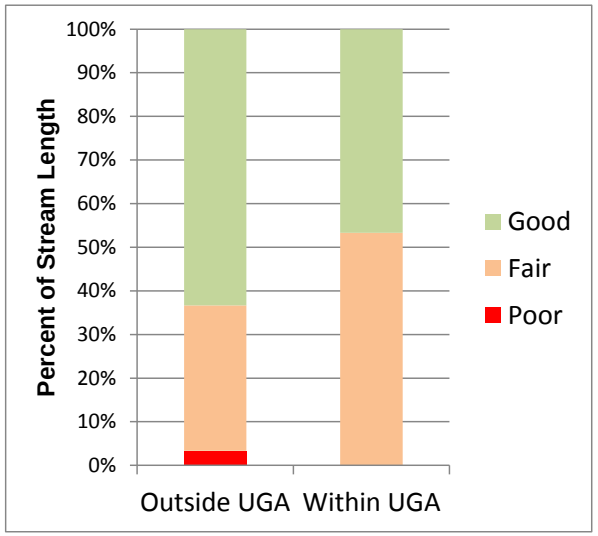
- Measured sediment contaminant concentrations did not typically exceed sediment quality standards within or outside UGAs



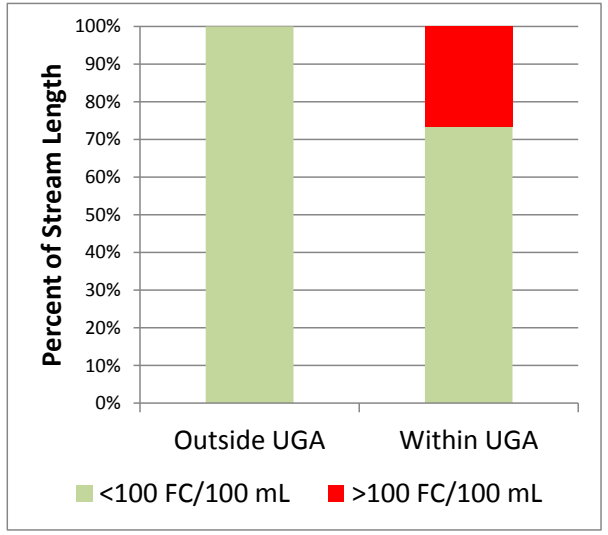
Q1: Water Quality Status

- Status based on WQI and temperature similar inside and outside UGAs
- Greater proportion of stream length within UGAs in poor condition based on Fecal Coliform bacteria and Total Phosphorus

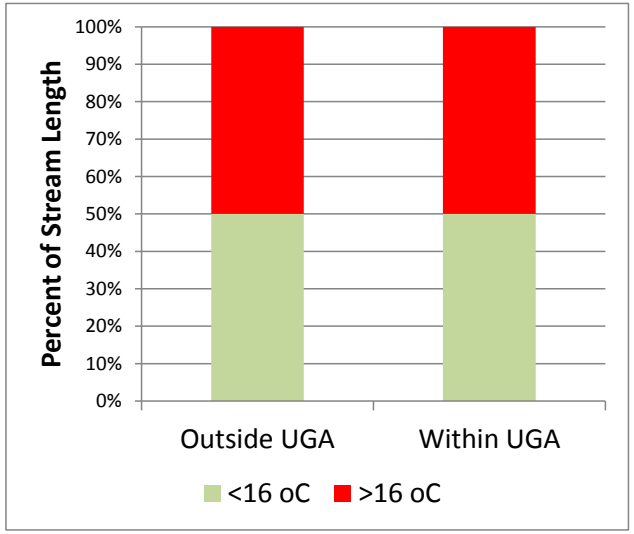
Annual Water Quality Index



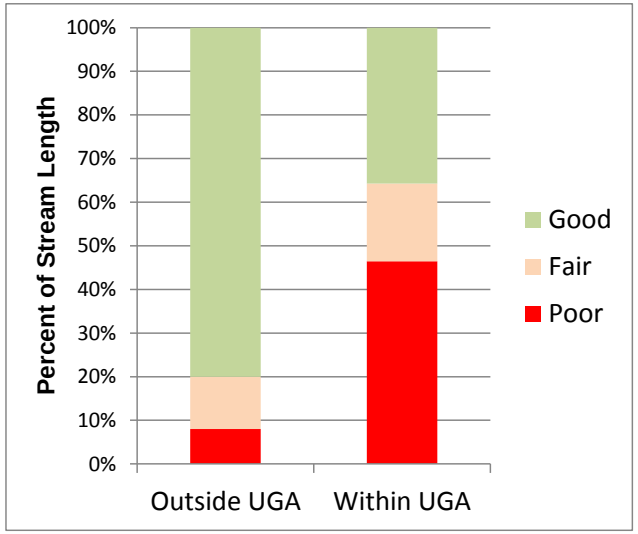
Fecal Coliform Bacteria



Temperature

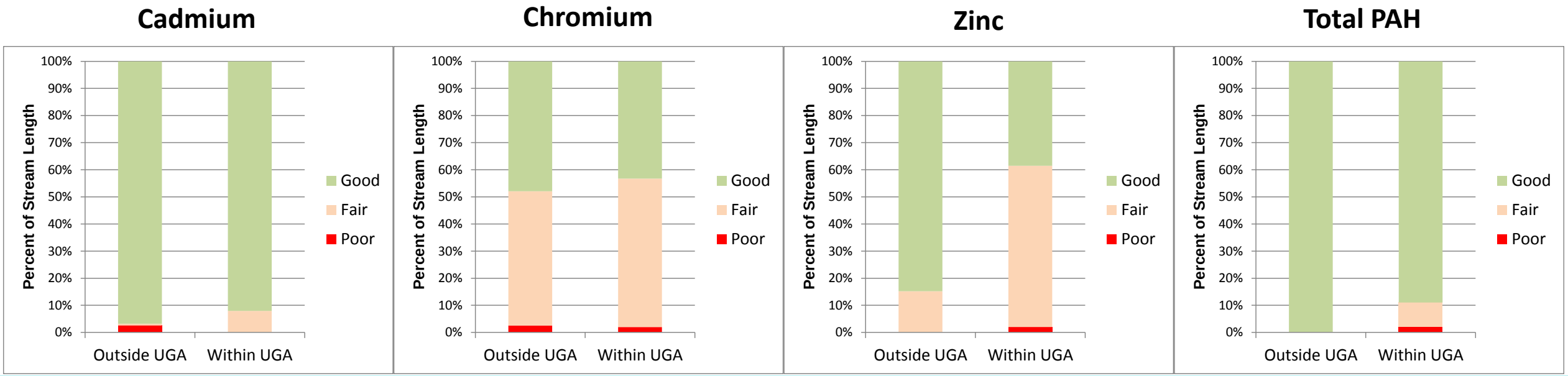


Total Phosphorus



Q1: Sediment Quality Status

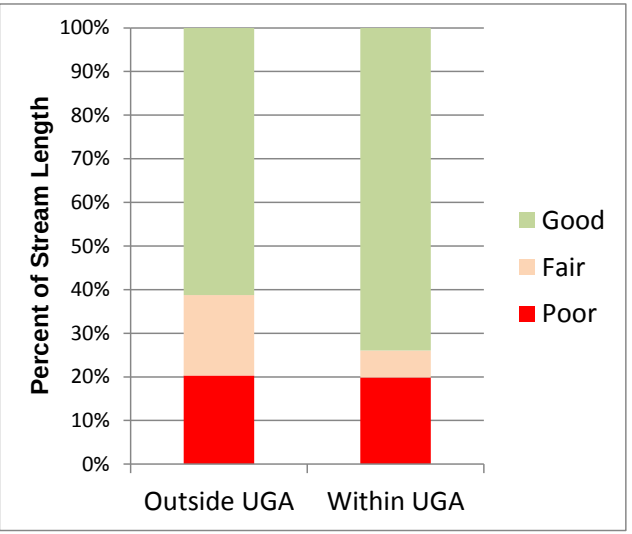
- Highest concentrations measured typically occurred within UGAs
- Zinc concentrations distinctly elevated within UGAs



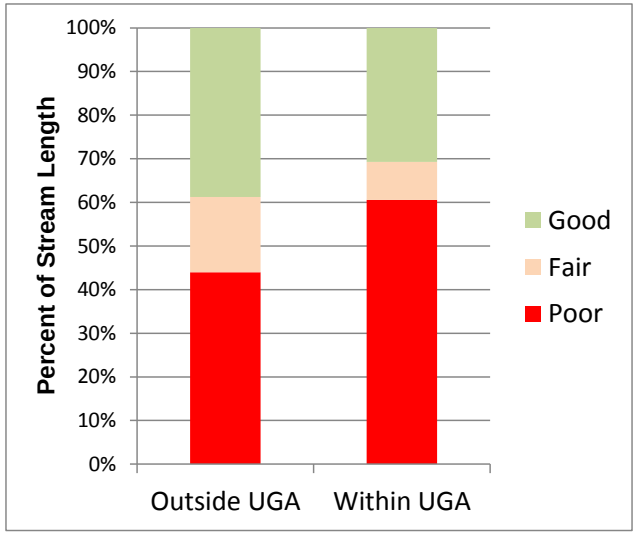
Q1: Habitat Status

- Habitat in poor condition similar within and outside UGAs except for wood volume and pool area
- Habitat poor + fair condition similar within and outside UGAs except for stream substrate status

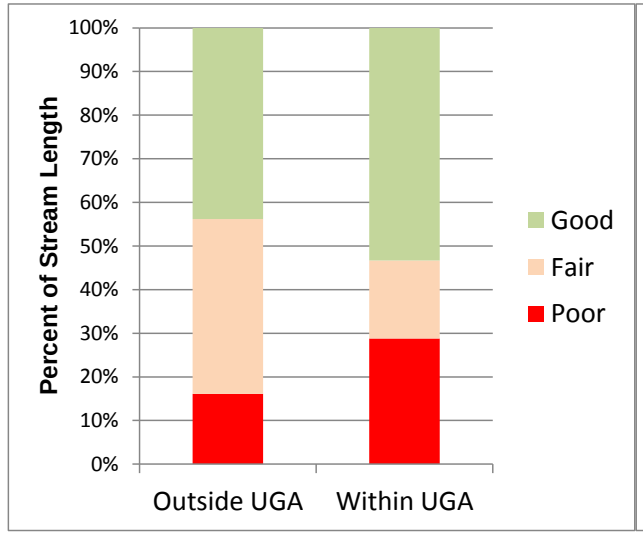
Riparian Condition



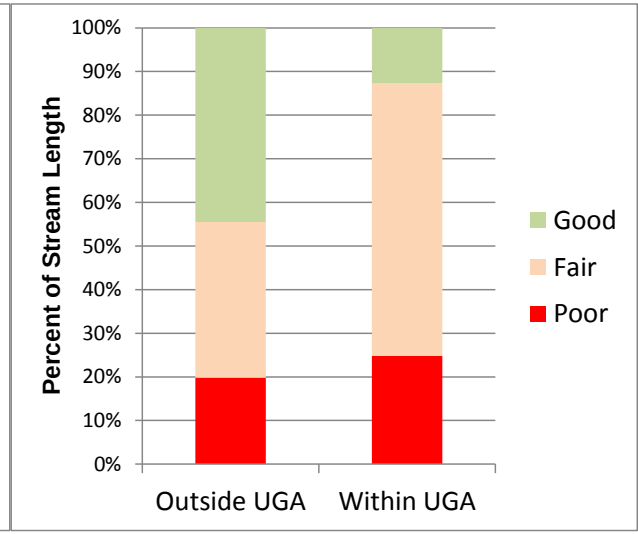
Large Wood Volume



Residual Pool Area

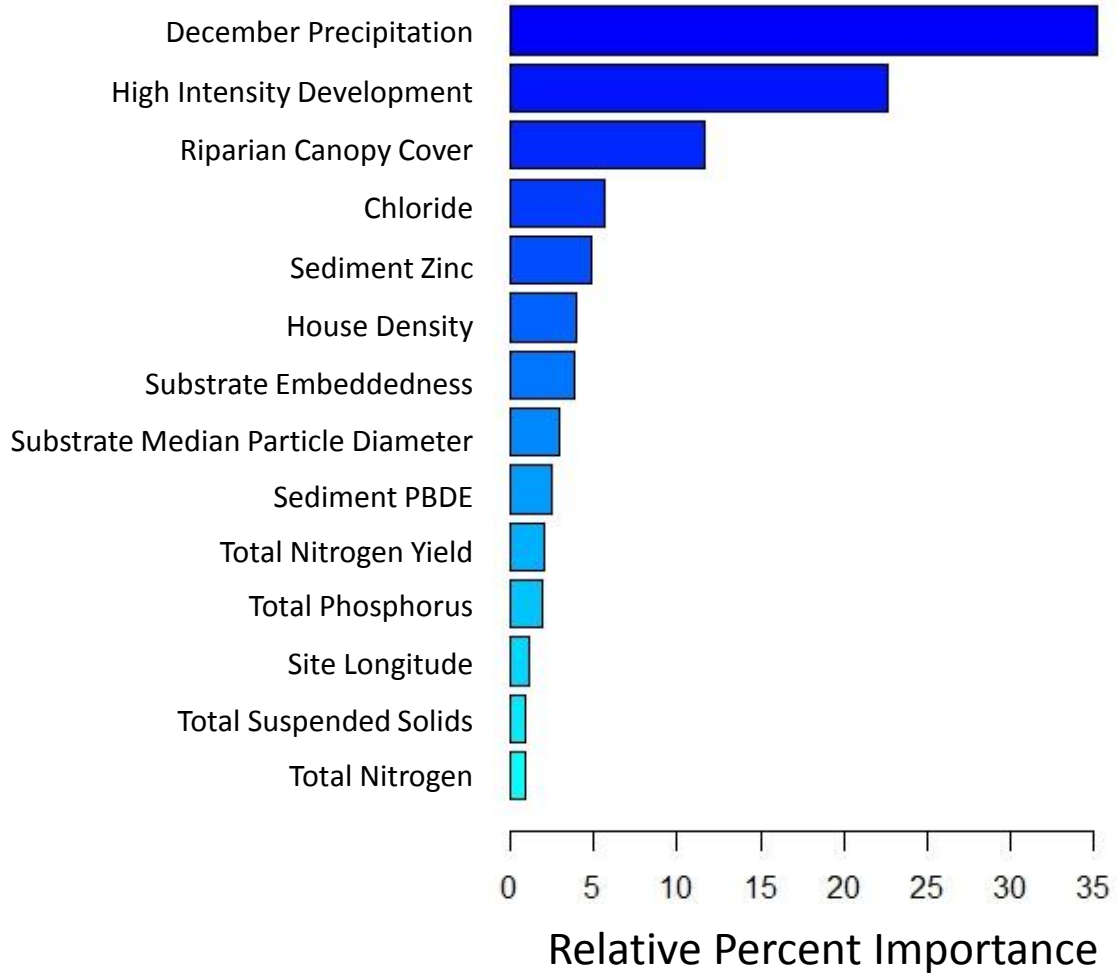


Median Particle Size (D50)



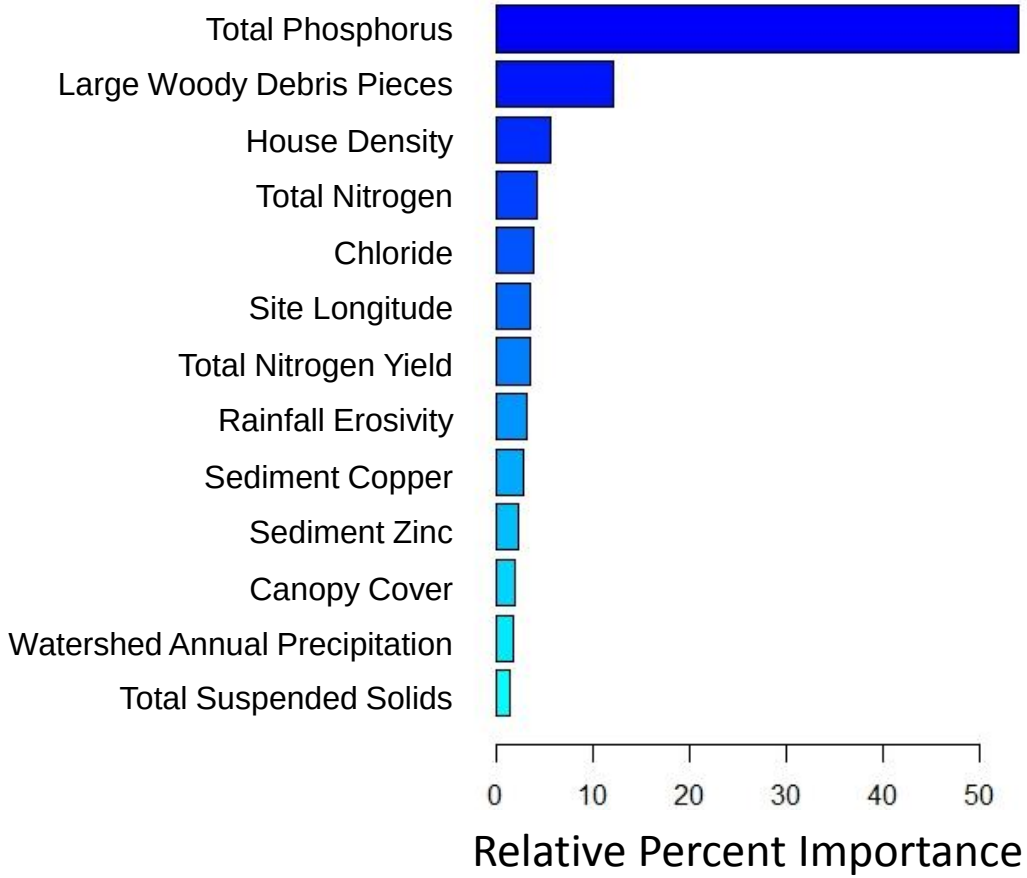
Q2/Q3: Natural and human variables that correlate with BIBI scores

- Natural variables
  - Mean December precipitation
  - Longitude
- Human variables
  - High Intensity Development
  - Riparian Canopy Cover
  - Chloride in water
  - Zinc in sediment
  - House density
  - Stream embeddedness
  - Etc



Q2/Q3: Natural and human variables that correlate with Trophic Diatom Index

- Natural variables
  - Longitude
- Human variables
  - Total Phosphorus
  - Large Wood Volume
  - House Density
  - Total Nitrogen
  - Chloride
  - Watershed Total Nitrogen Yield
  - Etc



Work on answering remaining questions in progress

- **Q4:** How does SAM results compare to other monitoring programs in Puget Sound?
- **Q5:** What parameters would be carried forward for trend assessment of SAM stream monitoring in the future, and at what timing and frequency?

SAM Puget Lowlands Streams Status & Trends Current Schedule

- Draft report in progress
- Compete draft report for review by August 2017
- Final report completed by December 2017

Questions?



