Stormwater Action Monitoring: 2015 Puget Lowland Ecoregion Stream Status and Trends study findings

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Curtis DeGasperi
King County
Science and Technical Support Section

Project Team: Brandi Lubliner, Ecology/SAM Coordinator; Rich Sheibley, USGS; Chad Larson, Ecology; Leska Fore, Puget Sound Partnership

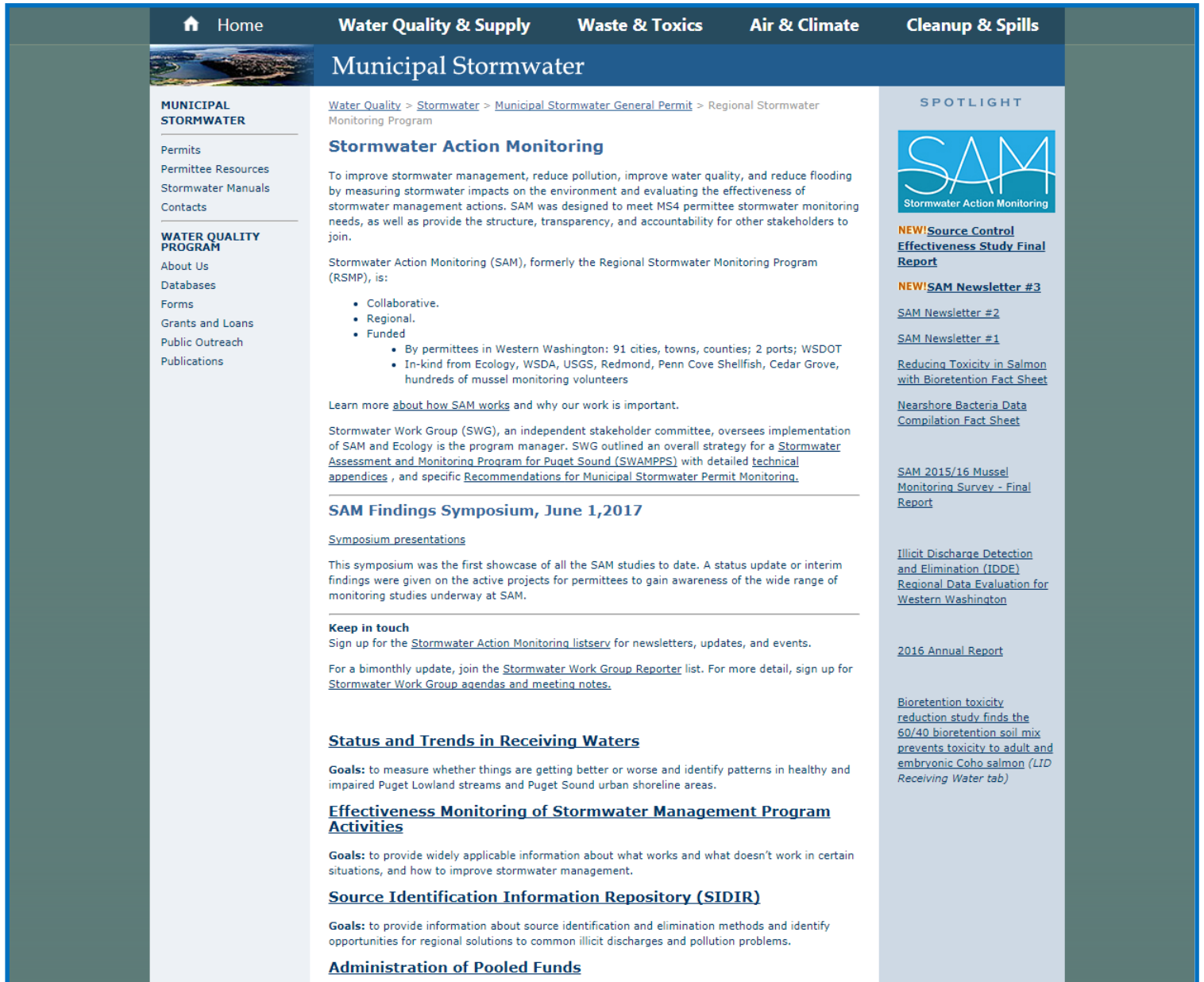
Some history…(emphasis mine)

- Clean Water Act (1972 and subsequent amendments)
  - "The objective of this Act is to restore and maintain the chemical, physical, and ***biological integrity*** of the Nation's waters."

The Clean Water Act celebrated its 45th birthday on October 18, 2017!

Part of a Regional Stormwater Monitoring Program

- Status & Trends
  - Small streams
  - Marine nearshore
- Effectiveness Studies
- Source Identification



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Stormwater Action Monitoring

To improve stormwater management, reduce pollution, improve water quality, and reduce flooding by measuring stormwater impacts on the environment and evaluating the effectiveness of stormwater management actions. SAM was designed to meet MS4 permittee stormwater monitoring needs, as well as provide the structure, transparency, and accountability for other stakeholders to join.

Stormwater Action Monitoring (SAM), formerly the Regional Stormwater Monitoring Program (RSMP), is:

- Collaborative.
- Regional.
- Funded
  - By permittees in Western Washington: 91 cities, towns, counties; 2 ports; WSDOT
  - In-kind from Ecology, WSDA, USGS, Redmond, Penn Cove Shellfish, Cedar Grove, hundreds of mussel monitoring volunteers

Learn more about how SAM works and why our work is important.

Stormwater Work Group (SWG), an independent stakeholder committee, oversees implementation of SAM and Ecology is the program manager. SWG outlined an overall strategy for a Stormwater Assessment and Monitoring Program for Puget Sound (SWAMPPS) with detailed technical appendices , and specific Recommendations for Municipal Stormwater Permit Monitoring.

SAM Findings Symposium, June 1,2017

Symposium presentations

This symposium was the first showcase of all the SAM studies to date. A status update or interim findings were given on the active projects for permittees to gain awareness of the wide range of monitoring studies underway at SAM.

Keep in touch
Sign up for the Stormwater Action Monitoring listserv for newsletters, updates, and events.

For a bimonthly update, join the Stormwater Work Group Reporter list. For more detail, sign up for Stormwater Work Group agendas and meeting notes.

Status and Trends in Receiving Waters

Goals: to measure whether things are getting better or worse and identify patterns in healthy and impaired Puget Lowland streams and Puget Sound urban shoreline areas.

Effectiveness Monitoring of Stormwater Management Program Activities

Goals: to provide widely applicable information about what works and what doesn't work in certain situations, and how to improve stormwater management.

Source Identification Information Repository (SIDIR)

Goals: to provide information about source identification and elimination methods and identify opportunities for regional solutions to common illicit discharges and pollution problems.

Administration of Pooled Funds

SPOTLIGHT

SAM Stormwater Action Monitoring

NEW! Source Control Effectiveness Study Final Report

NEW! SAM Newsletter #3

SAM Newsletter #2

SAM Newsletter #1

Reducing Toxicity in Salmon with Bioretention Fact Sheet

Nearshore Bacteria Data Compilation Fact Sheet

SAM 2015/16 Mussel Monitoring Survey - Final Report

Illicit Discharge Detection and Elimination (IDDE) Regional Data Evaluation for Western Washington

2016 Annual Report

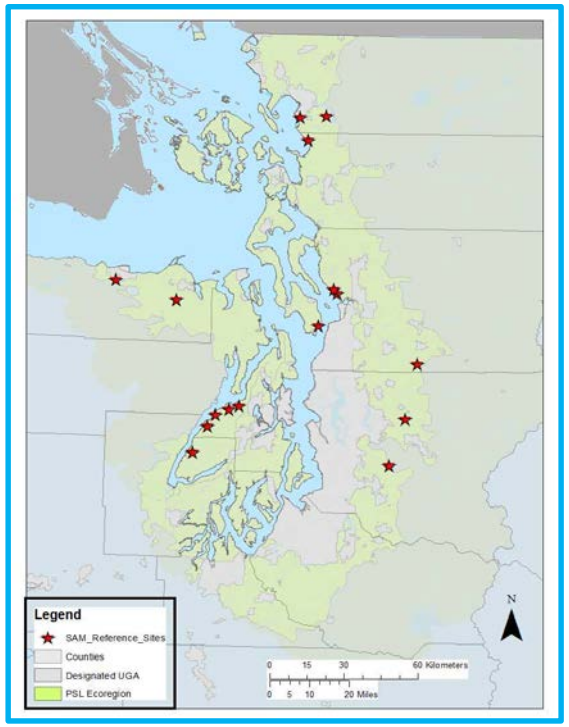
Bioretention toxicity reduction study finds the 60/40 bioretention soil mix prevents toxicity to adult and embryonic Coho salmon *(LID Receiving Water tab)*

Big Questions

- Status: How bad is it?
- Trends: Are things getting better or worse?

Followed EPA status assessment approach

- Need to set thresholds for good, fair, and poor
  - Fixed thresholds (e.g., literature, state standards)
  - Distribution based thresholds (from 'least-disturbed' reference sites)



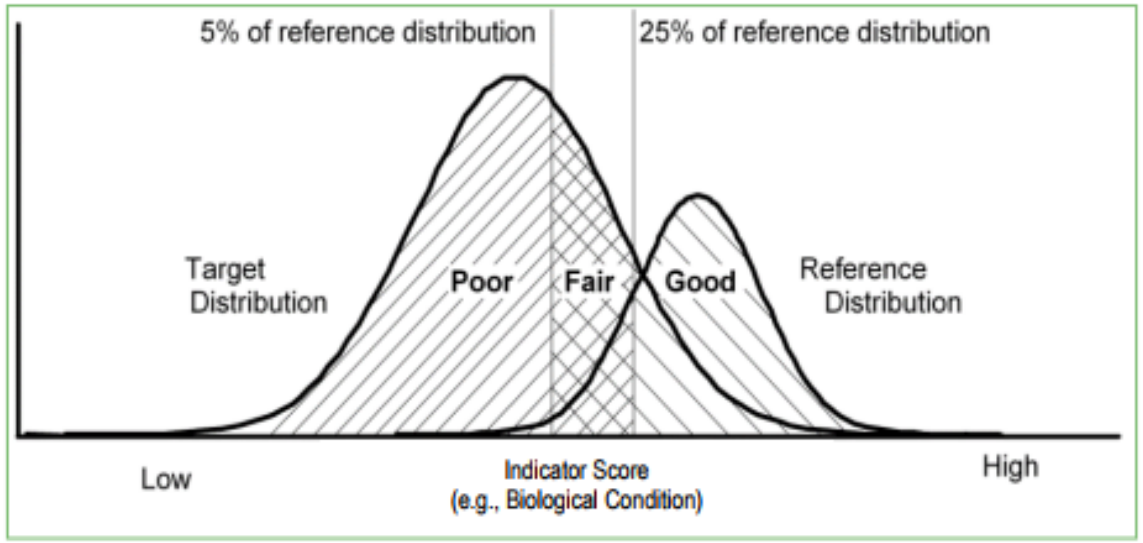


Figure 7. Reference condition thresholds used for good, fair and poor assessment (EPA/NRSA).

SAM 2015: Small Streams Status and Trends Monitoring

- **Puget Lowland Small Streams**
  - Site selection – Summer 2014
  - Monitoring for monthly WQ Jan – Dec 2015
  - Stream habitat and sediment Summer 2015

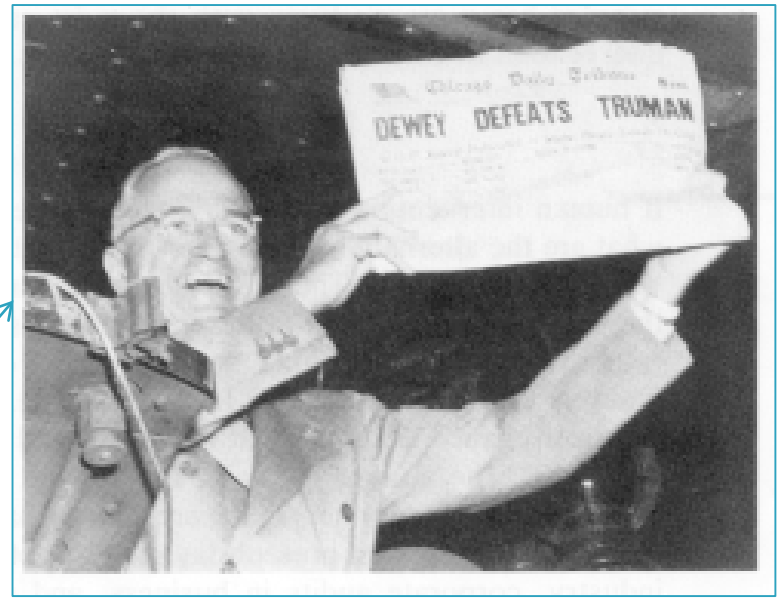
- **Monthly water quality**
  - Nutrients, fecal coliform, hardness, DOC, T, DO, pH, TSS, turbidity
  - Metals (total/dissolved)
  - PAHs
  - Stage and stream discharge

- **Summer Watershed Health**
  - Benthic macroinvertebrates
  - Periphyton
  - Physical habitat
  - Sediment chemistry (sieved)
    - PAHs, phthalates, roadside use pesticides, PCBs, PBDEs, metals, TOC

Sampling design probabilistic or "survey-based"

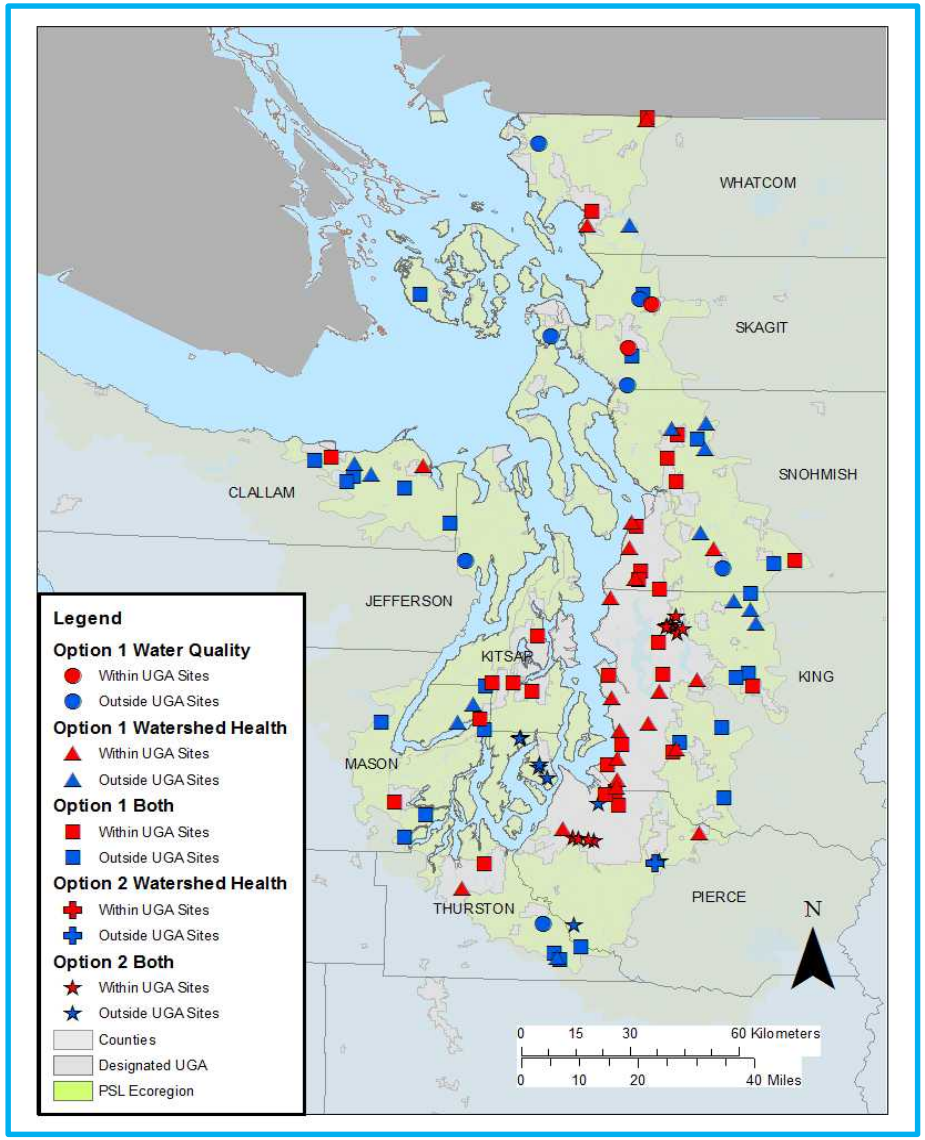
- Analogous to **modern** polling methods
- A complete census is not possible
- Survey-based sampling is efficient
- Survey-based sampling provides confidence bounds on results

We avoided this:



Prior to the 1948 presidential election, polling methods were not based on random polling.

Sites Within and Outside Urban Growth Areas

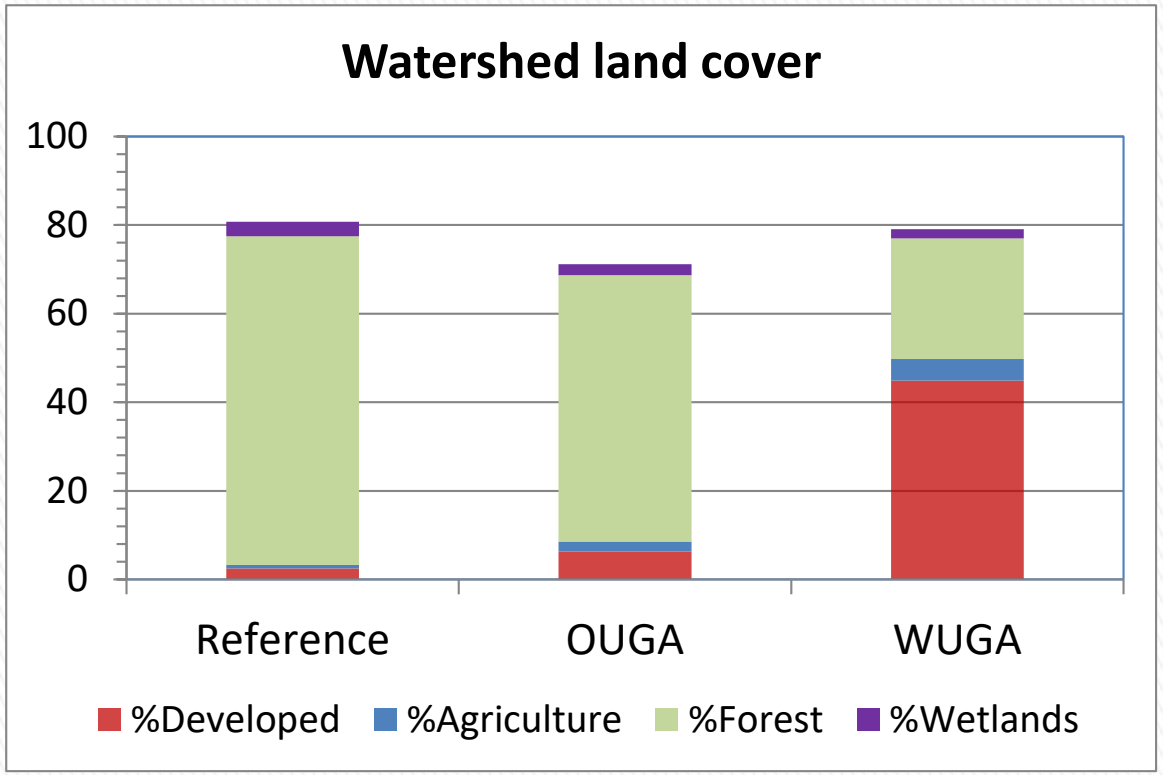


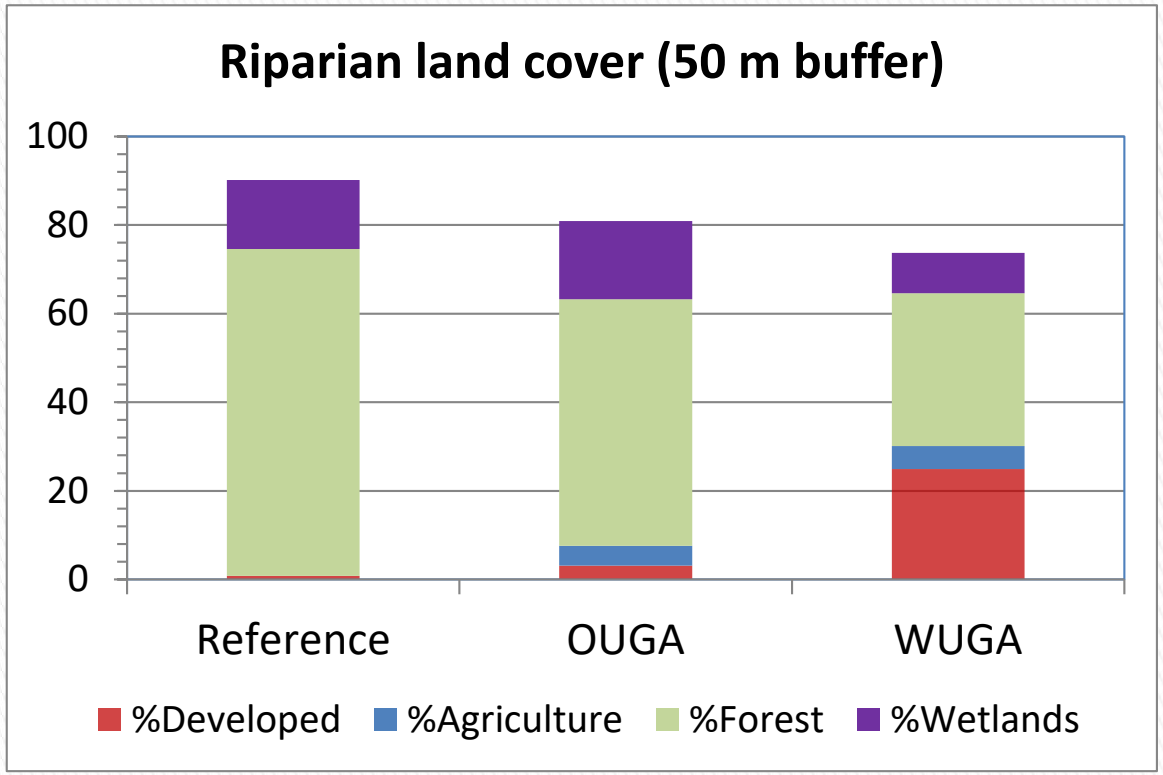
Sampling was also spatially balanced

A total of 105 Watershed Health sites

Monthly water quality sampling attempted at 80 sites, but with mixed success due to unusually low flows in 2015

Watershed and riparian GIS analysis





Leveraged USGS NAWQA study GIS expertise – Sheibley et al. (2017)

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

Parameter	Detection Freqency	
	Outside UGA	Within UGA
Ammonia	B	A
Arsenic	A	A
Arsenic dissolved	A	A
Chloride	A	A
Chromium	A	A
Chromium dissolved	B	A
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

Water Quality ---------

Parameter	Detection Freqency	
	Outside UGA	Within UGA
Naphthalene	C	B
Zinc	C	B
Zinc dissolved	C	B
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
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

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

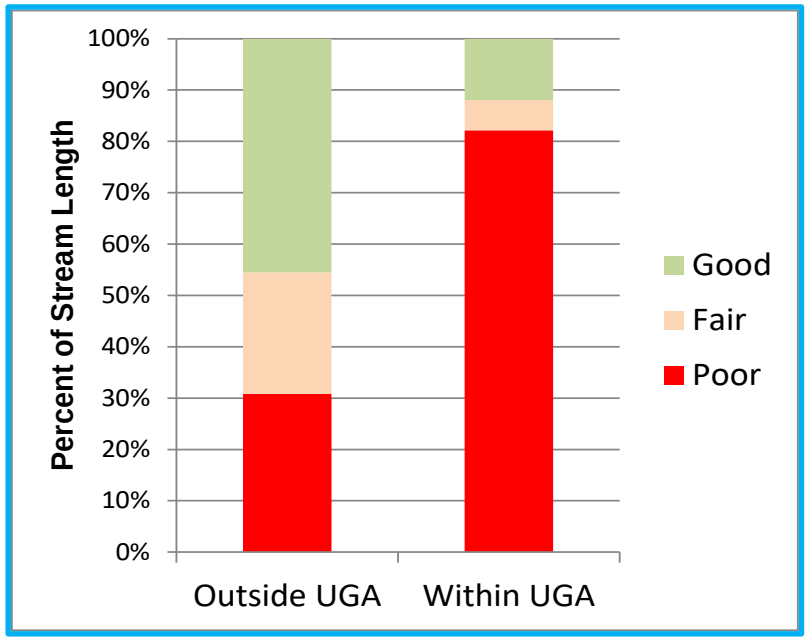
Sediment Quality -----

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
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

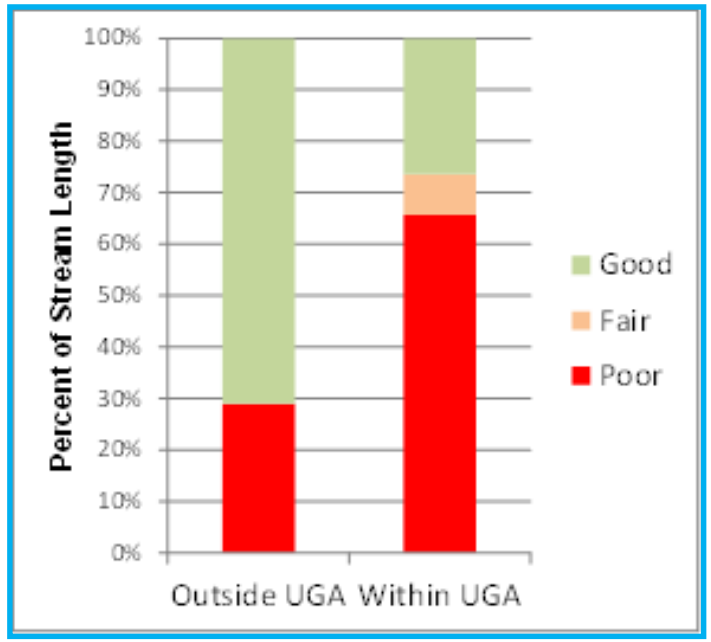
Biological Status

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

Benthic Index of Biotic Integrity



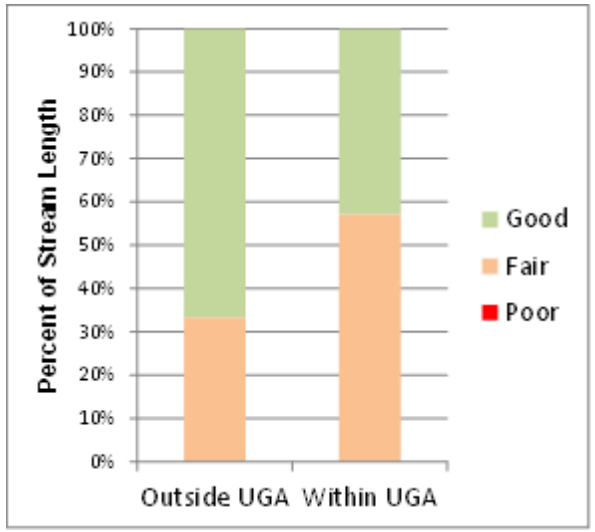
Trophic Diatom Index



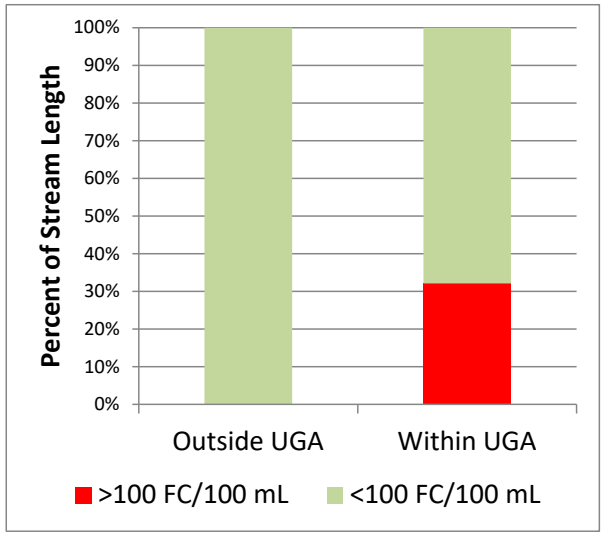
Water Quality Status

- Status based on WQI somewhat worse inside vs outside UGAs. Temperature status similar inside vs outside.
- Greater proportion of stream length within UGAs in poor condition based on Fecal Coliform bacteria and Total Phosphorus

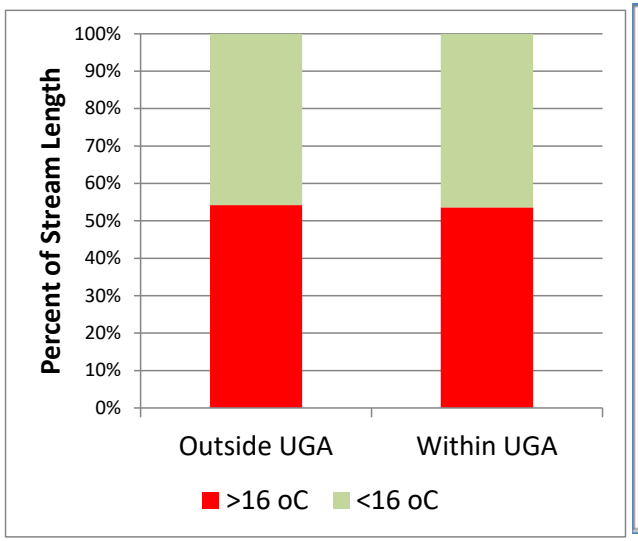
Annual Water Quality Index



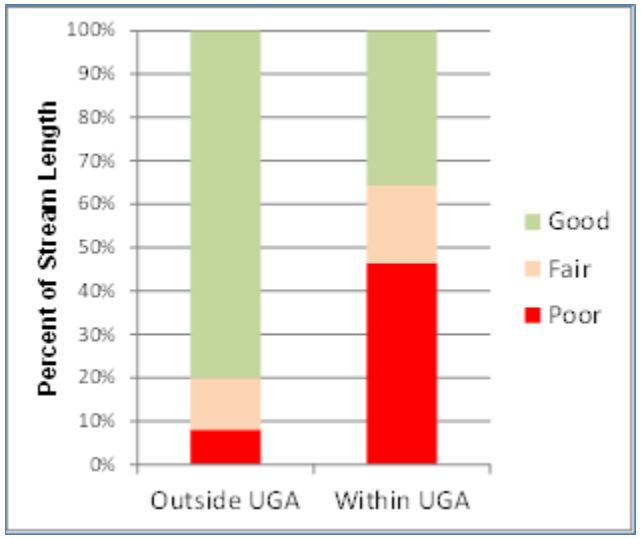
Fecal Coliform Bacteria



Temperature

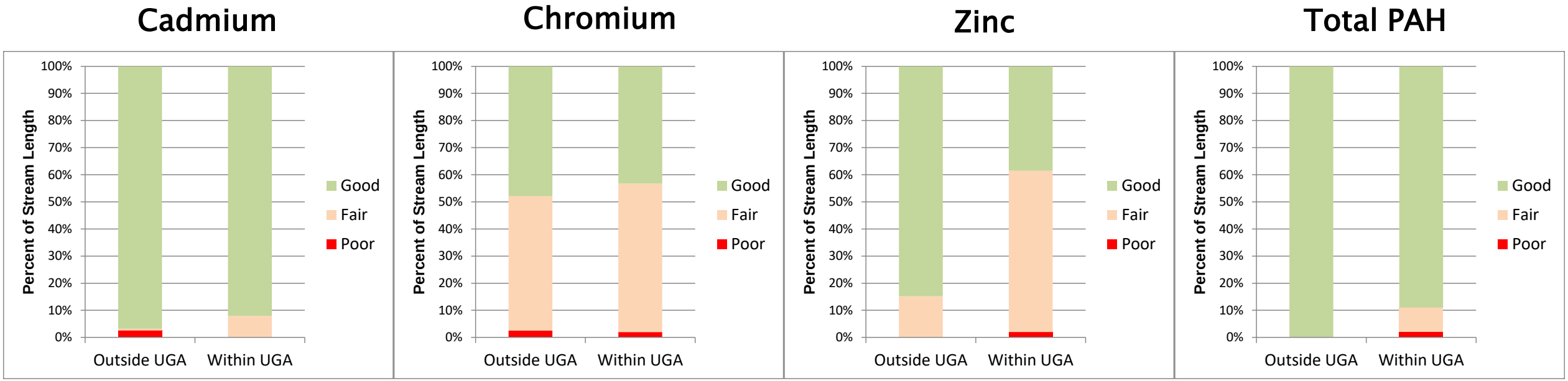


Total Phosphorus



Sediment Quality Status

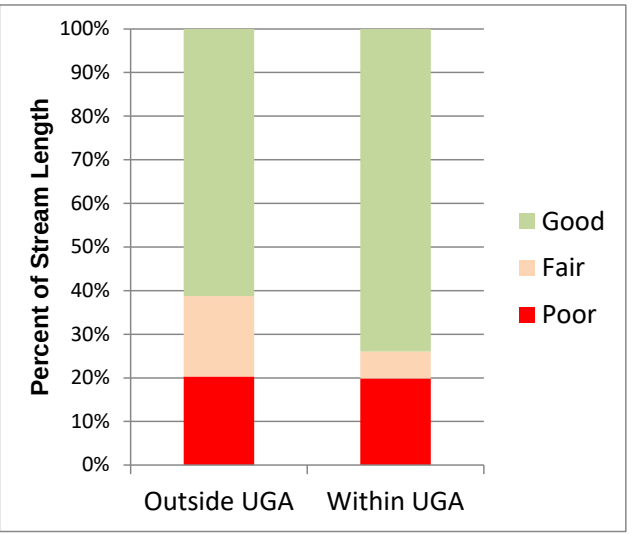
- Highest concentrations measured typically occurred within UGAs
- Zinc concentrations distinctly elevated within UGAs



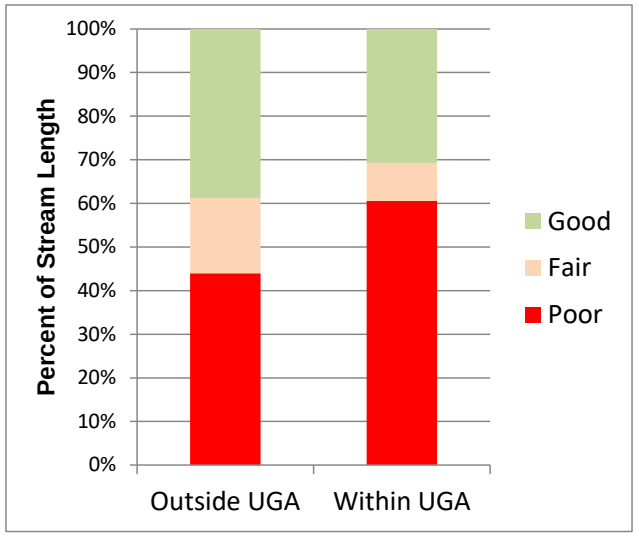
Habitat Status

- 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

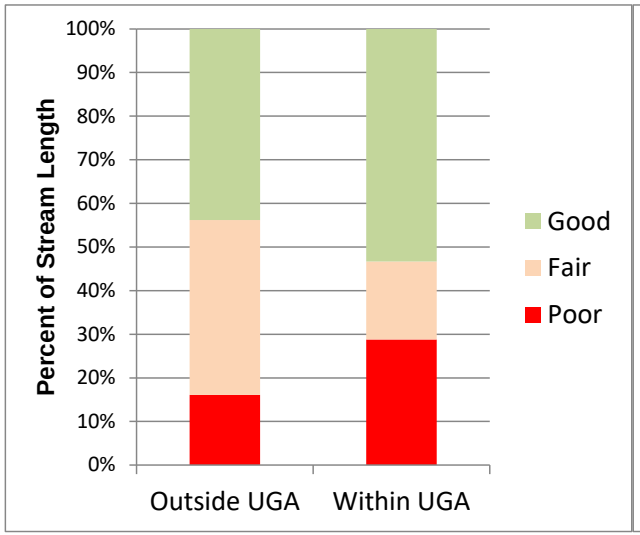
Riparian Condition



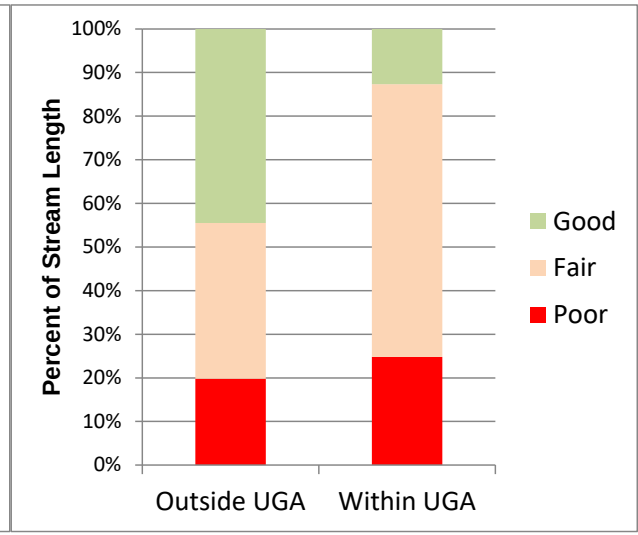
Large Wood Volume



Residual Pool Area



Median Particle Size (D50)



Another logical question

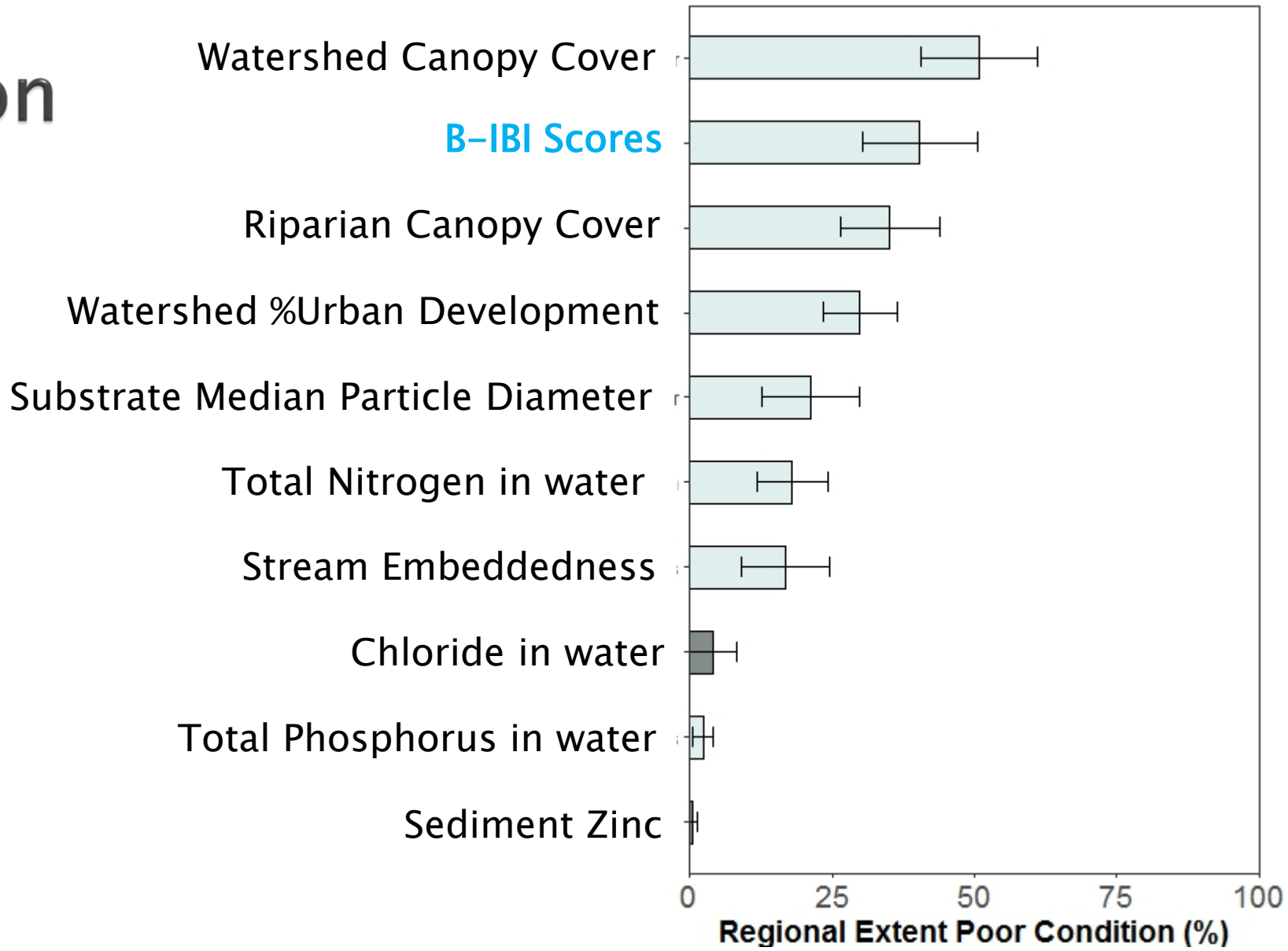
- What are the causes of poor biological condition?

Relative Risk and Attributable Risk (RR/AR)

- Assumes causal relationship between stressor and biological response
- Assumes stressor's effects would be completely reversed if stressor were eliminated
- Assumes the effects of multiple stressors are independent and act in isolation from other stressors

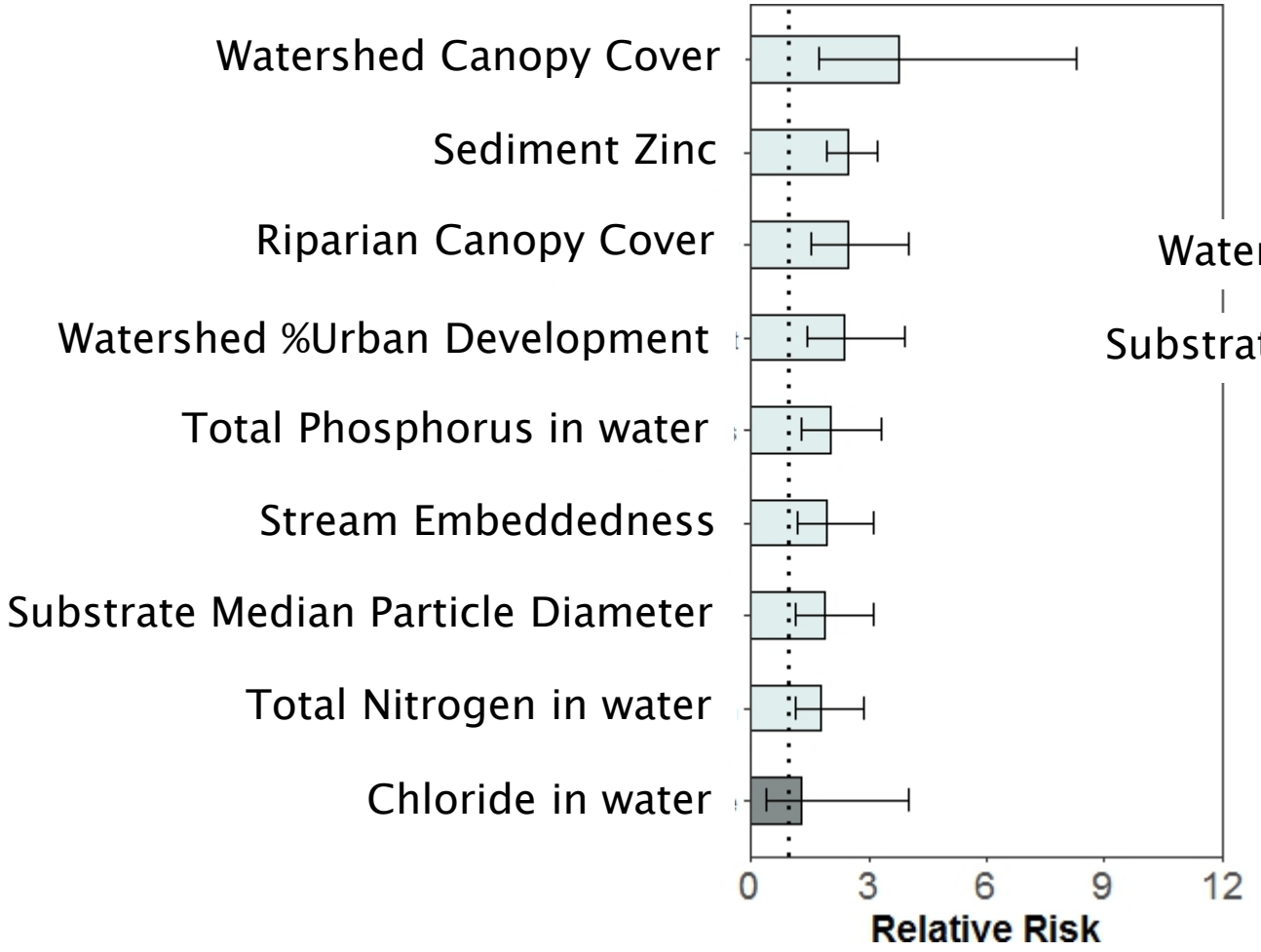
Stressor → Biological Response

Extent of poor condition

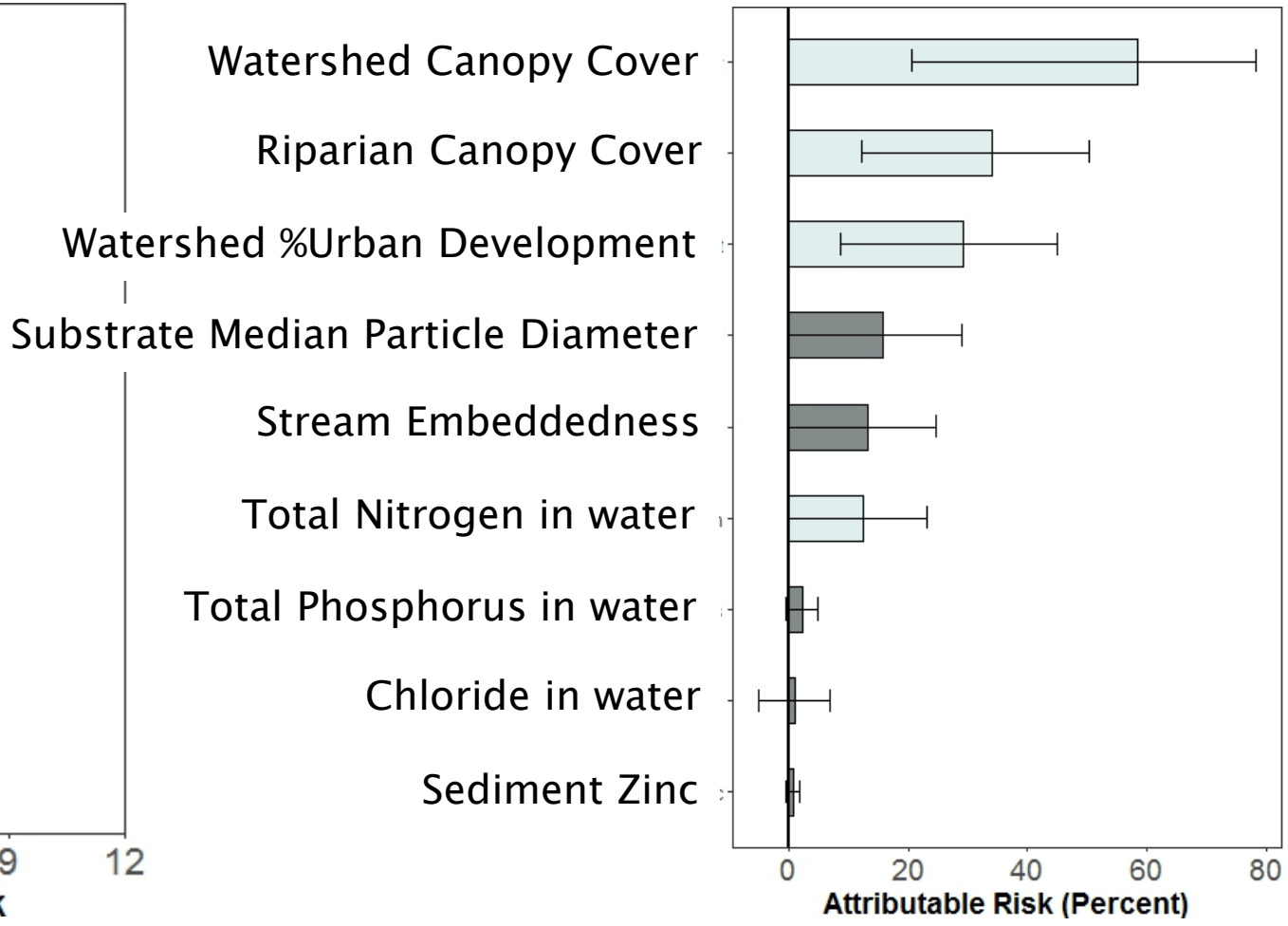


RR/AR for B-IBI scores

Relative Risk



Attributable Risk



SAM Streams Status & Trends Current Schedule

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

SAM
Stormwater Action Monitoring

Questions?