Swanson Environmental Strategies

Thirty Years of Experience in Environmental Services

How Much is Too Much?

Effects-Based versus Stressor-Based Benchmarks and Thresholds and Some Examples from the Elk Valley in the East Kootenays

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Outline

1. Effects-based versus stressor-based indicators, thresholds and benchmarks

2. Thresholds, Benchmarks and Targets for the Elk Valley

3. The Importance of Collaboration in the Development of Thresholds and Benchmarks

Start with Indicators*

Indicators: Surrogate measures used to represent, monitor, or assess condition, state, change in or stress to a Valued Component

"Tell us something about something for some reason"

Measurement

Valued Component

Management, Monitoring, Research

* Adapted from Presentation by Bram Noble

Two Types of Indicators

Outcome (i.e. effects-based):

- Provide measure of the <u>effects</u> on VCs
  - e.g. fish abundance

Input (i.e. stressor-based):

- Provide measure of the condition of / trends in <u>stress</u>, <u>disturbance</u>, or <u>risk</u> to the VCs
  - E.g. % disturbed riparian area

Characteristic of Good Indicators

"Good indicators for cumulative effects must be indicative of the cause(s) of change/sources of stress, <u>not only the existence of change</u>".

Bram Noble

Is this ↓ related to this? ↓

Some Definitions

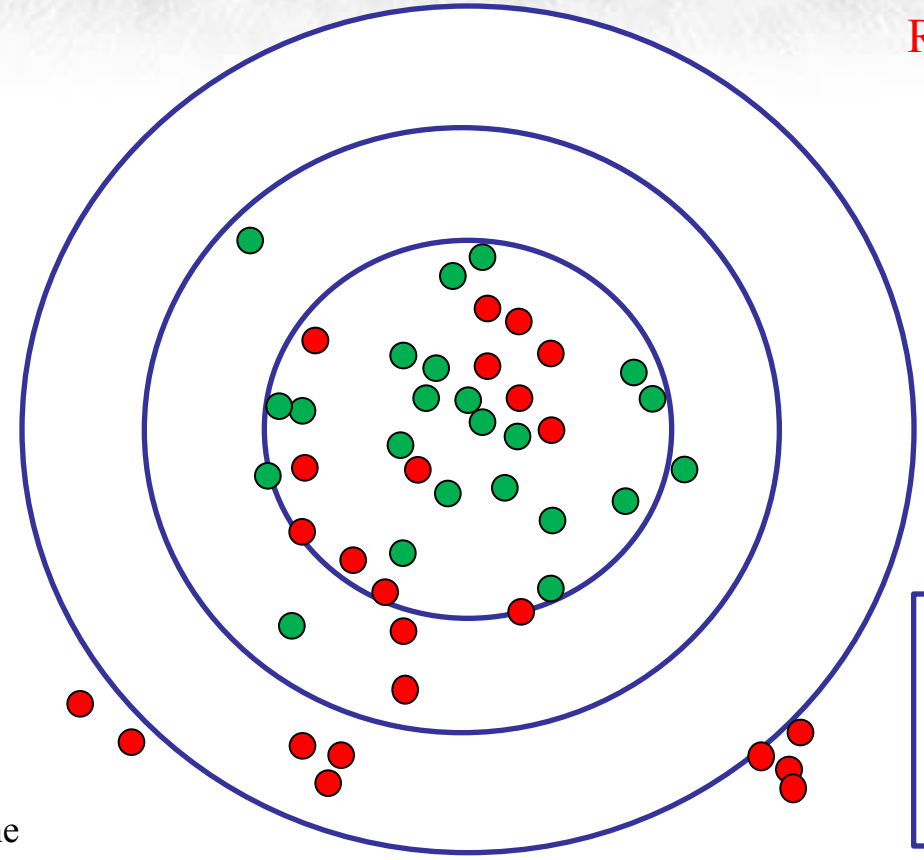
- **Thresholds** are based on **benchmarks** established from laboratory testing or field observations of past or current "reference conditions" or trends – thus they are knowledge based.
- **Targets** incorporate desired state or condition of a VC. Targets are established as a matter of policy or as legal requirements, and thus must be met.

Effects-Based vs Stressor-Based Thresholds

- Which are most useful to decision-makers?
- Which are the most well understood?
- Which are useful across different types of human activities?
- Which are reliable over time?

Effect Threshold:
Benthic Invertebrate Community Structure

Green dots = reference
Red dots = mine-exposed

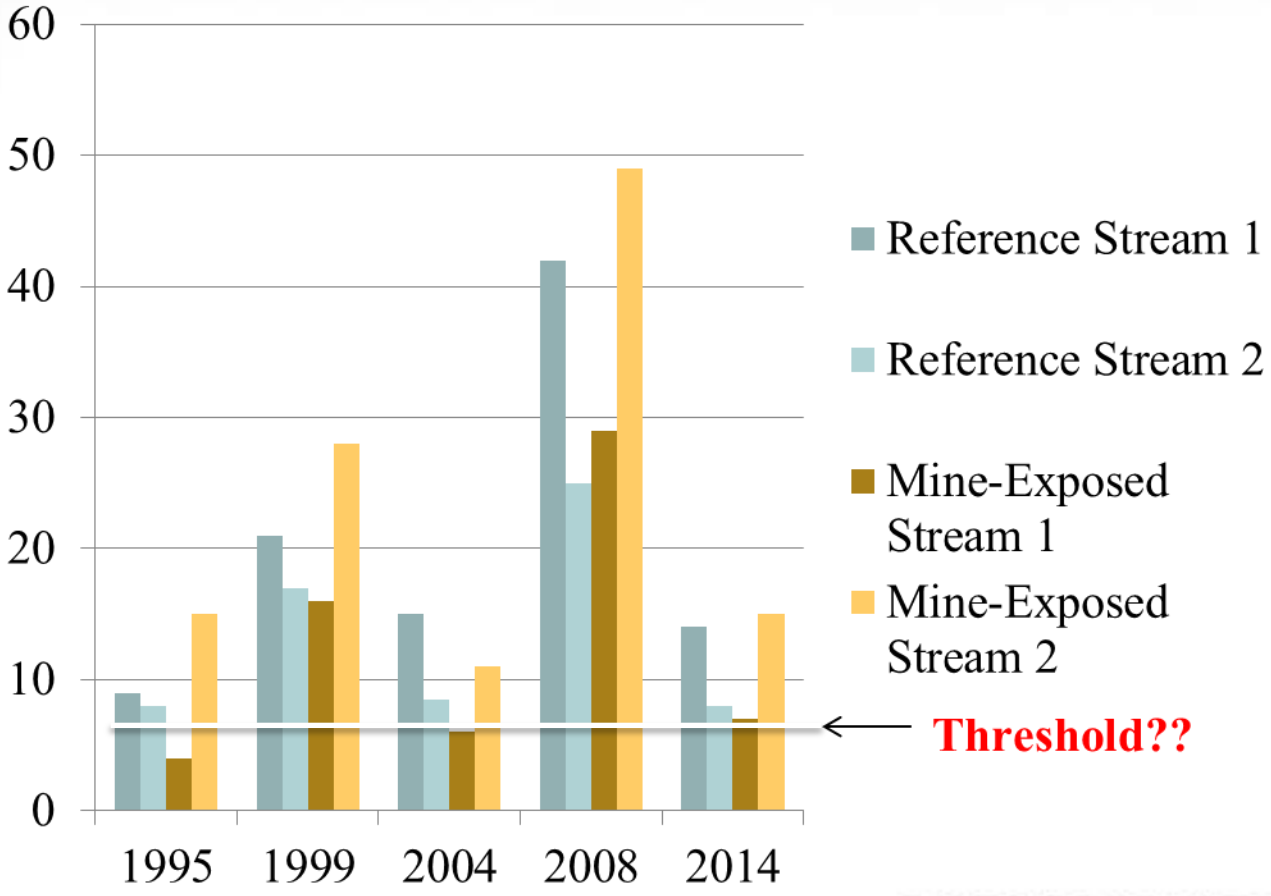


Threshold: 90th percentile? 99th percentile?

Moving outward from the centre circle, sampling sites are increasingly divergent from the reference condition

Effect Threshold:

Number of Westslope Cutthroat Trout > 300 mm/km*



How low is too low?

Natural variability versus effects?

*Hypothetical data; not from actual studies

Pros and Cons of Effects-Based Thresholds

Pros

- Meaningful because they are direct measurements of the valued component
- Can integrate effects across many human activities

Cons

- Not as useful to decision-makers because there may be prolonged scientific debate due to poorly-understood cause/effect linkages
- Data intensive and can be highly specific to location
- "After-the-Fact"

Stress Indicators:
Watershed Habitat*

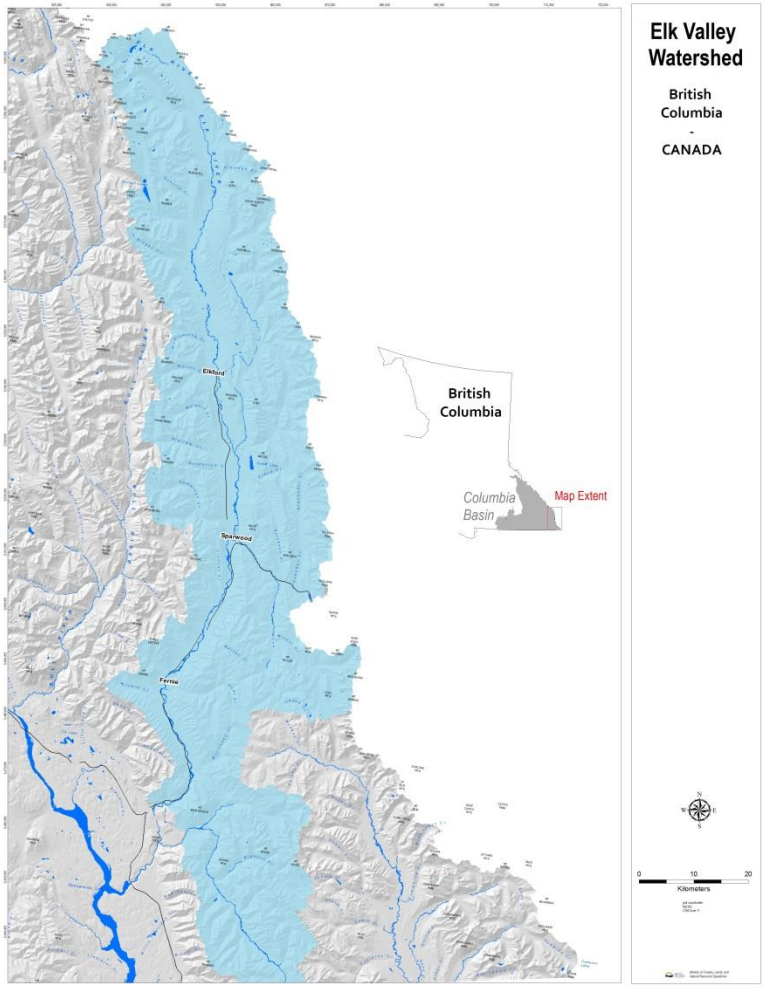
Habitat Indicator	Moderate Risk Benchmark	High Risk Benchmark
Road density for entire watershed	0.6 km/km^2	1.2 km/km^2
Road density less than 100 m from a stream	0.08 km/km^2	0.16 km/km^2
Stream crossing density (interior watersheds)	0.16/km^2	0.32/km^2
Stream crossing density (coastal watersheds)	0.40/km^2	0.80/km^2
Portion of fish-bearing streams logged	0.10 km/km	0.20 km/km
Peak flow index (proportion of basin that has been clear-cut)	0.12	0.24

* From Porter et al. 2015 Watershed Status Evaluation: An Assessment of 71 Watersheds Meeting BC's Fisheries Sensitive Watershed Criteria

Pros and Cons of Stressor-Based Thresholds

Pros	Cons
• Useful to decision-makers because easily linked to land use management • Usually well understood and can be efficiently measured • Reliable over time –thus useful for examining trends in accumulated stress	• Not always applicable across several human activities • Correlations with effects can be complex and confounded by other variables • Don't capture total effects, only the stressors we choose to measure

Elk Valley Cumulative Effects Management Framework (CEMF)



"Provide a practical, workable framework that supports decisions related to assessment, mitigation and management of cumulative effects in the Elk Valley"

www.elkvalleycemf.com

CEMF Riparian Habitat Indicators

1. Road density within riparian buffers
2. Disturbance (logging, fire history, etc.)
3. Stream crossings and cattle access points

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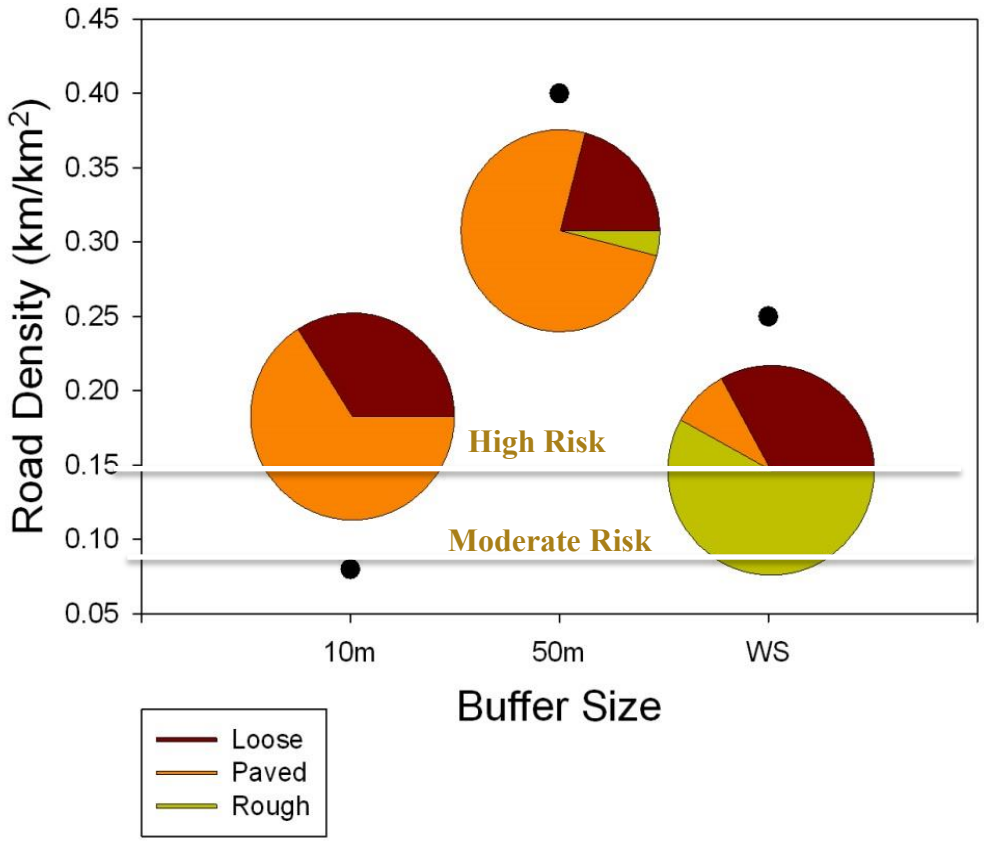
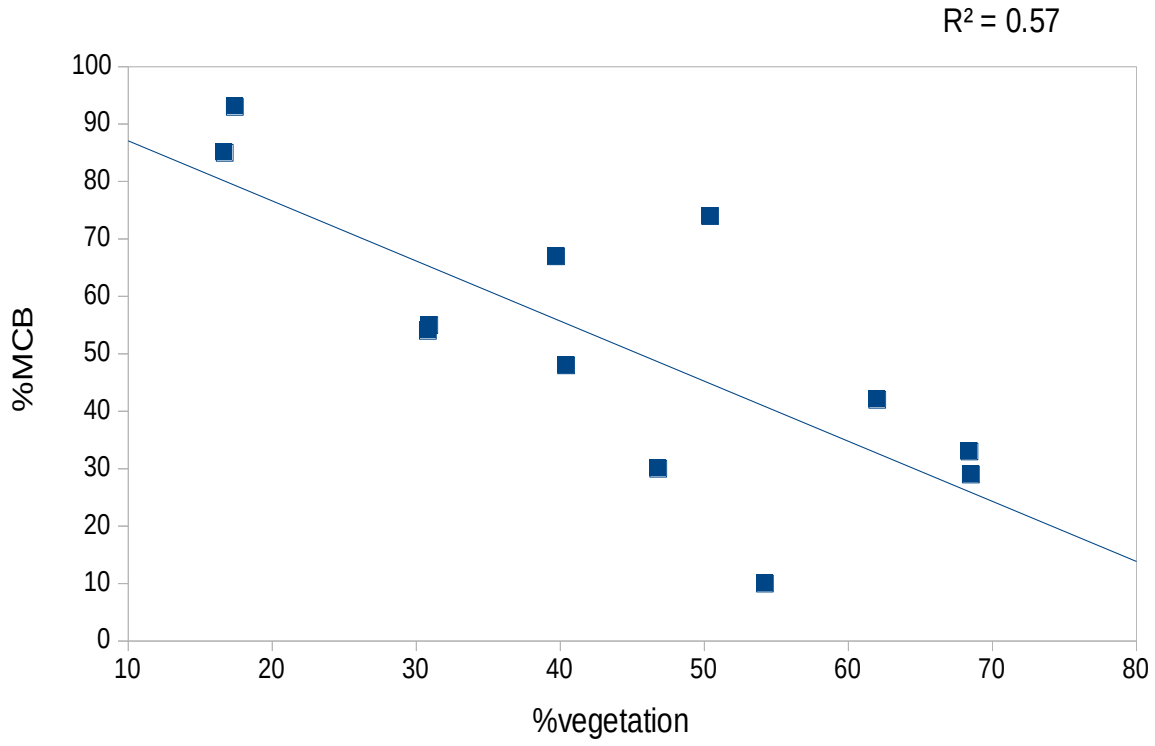
Road Density in the Michel Creek Watershed



Road density and classification for 10m buffer, 50 m buffer and watershed. The black dots represent road density in km/km^2 and the pie charts show the distribution of road type.

Road density within 50m of Michel Creek as well as for the entire watershed exceeded the "high risk" threshold presented in Porter et al. 2015

Retrospective Channel Morphology Assessment



More riparian vegetation = better channel condition

Example of Targets: The Elk Valley Water Quality Plan

Teck Coal Ltd. was required by BC MOE to develop the plan in consultation with regulators, the Ktunaxa and the public. The plan sets water quality targets for 5 water quality parameters, including selenium. The plan was adopted by the Province and Ktunaxa as policy and as such the targets must be met by Teck and all others seeking permits

Selenium Targets from the Elk Valley Water Quality Plan

Fish Species	**Benchmark (10% effect)**	**Short-term Target**			**Long-Term Target**		
		Upper Fording	Lower Fording	Elk	Upper Fording	Elk	Lake Koocanusa
Cutthroat Trout	70	63 (2019)	51 (2019)	19 (2023)	57 (2022)	19 (2023)	2 (2014)
Brown Trout	19						

Do Water Quality Targets Adequately Address Cumulative Effects in the Elk River?

NO, because cumulative stressors go beyond 5 parameters

- Land use (CEMF indicator)
- Riparian habitat degradation (CEMF VC with a suite of indicators)
- Effects on stream flow, channel morphology, erosion, landslides, climate change (CEMF indicators)
- Effects of recreational fishing
- Municipal discharges, etc.

The Importance of Collaboration

If there is:

- No meaningful discussion
  - Causing violation of interests or values
- Perceived or real unfairness
- Low trust

There can be deadlock when trying to deal with cumulative effects

Collaboration Regarding Thresholds and Targets

Accessible science

Inclusive discussion

Open dialogue about acceptable risk and how to deal with uncertainty

Can contribute to broadly-accepted thresholds and targets

Principles of Good Collaboration

Transparency – how did we derive benchmarks, thresholds and targets?

Engagement - did we engage early and often regarding how much is too much?

Accountability – is it clear who is accountable for which decisions?

Policy Coherence – is there consistency across levels of government and are policies applied uniformly across the province?

Discussion

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