



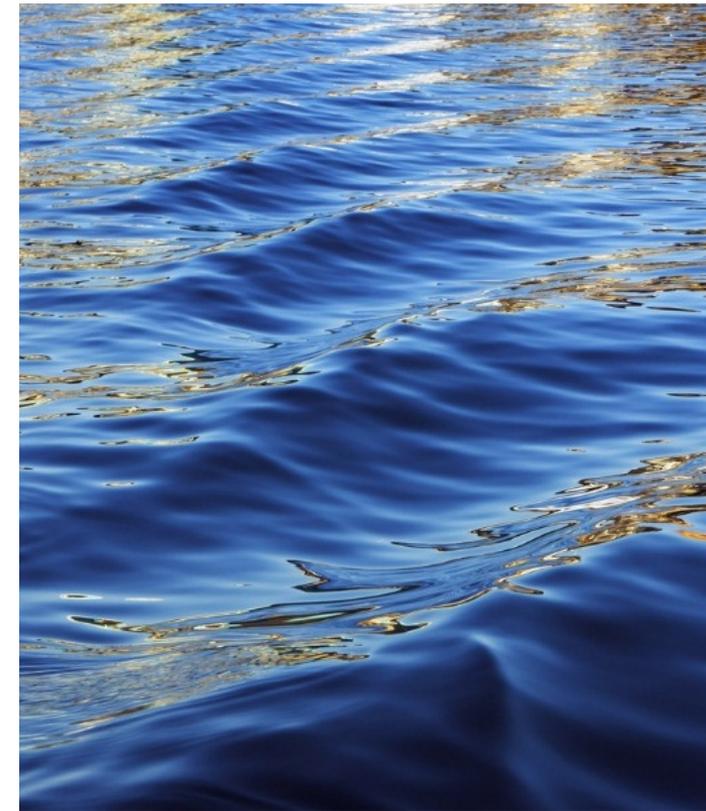
Fixing Streams, Step 1: Figuring Out What to Fix

Science Seminar
November 2019

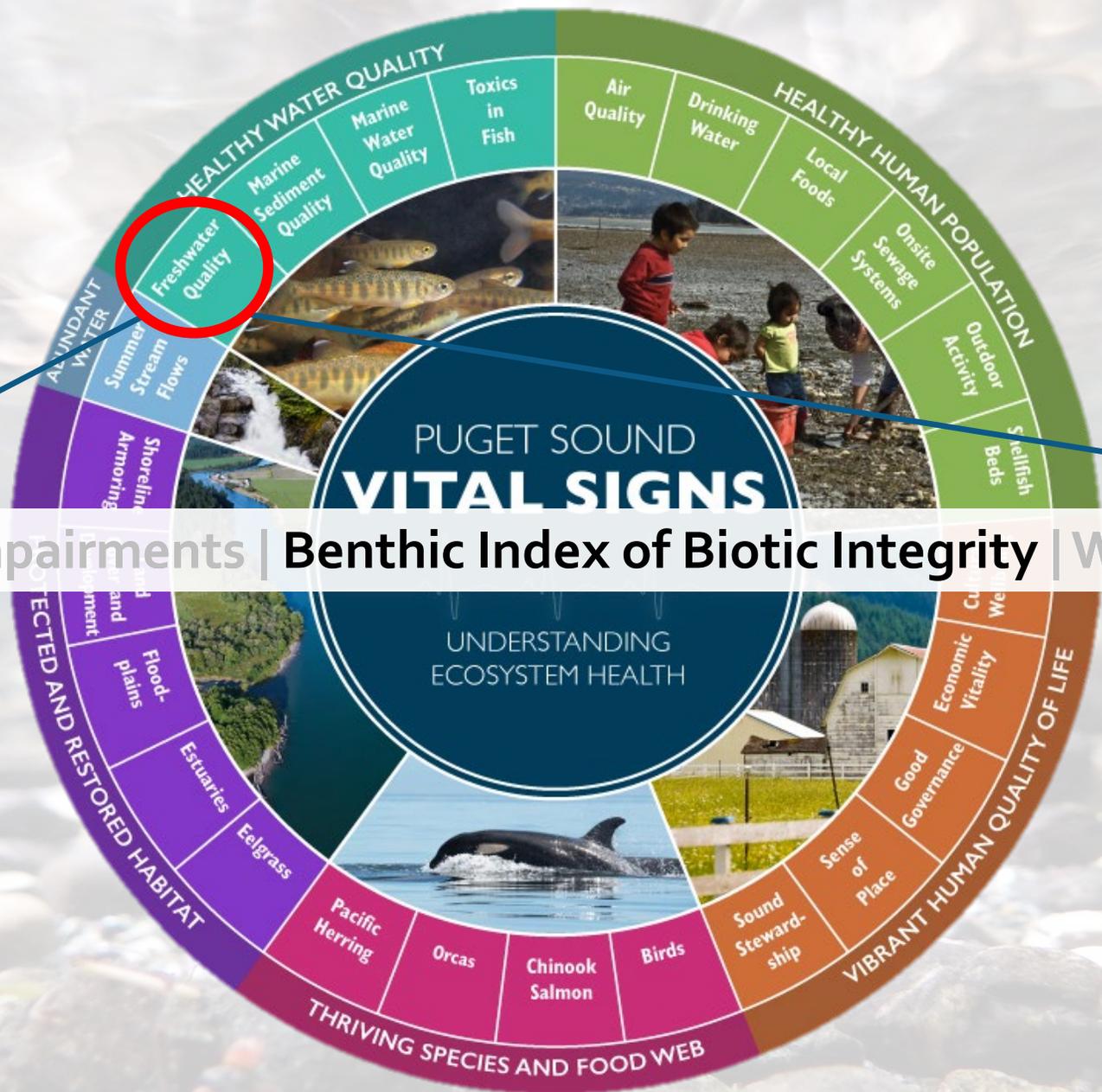
Water and Land Resources Division



King County

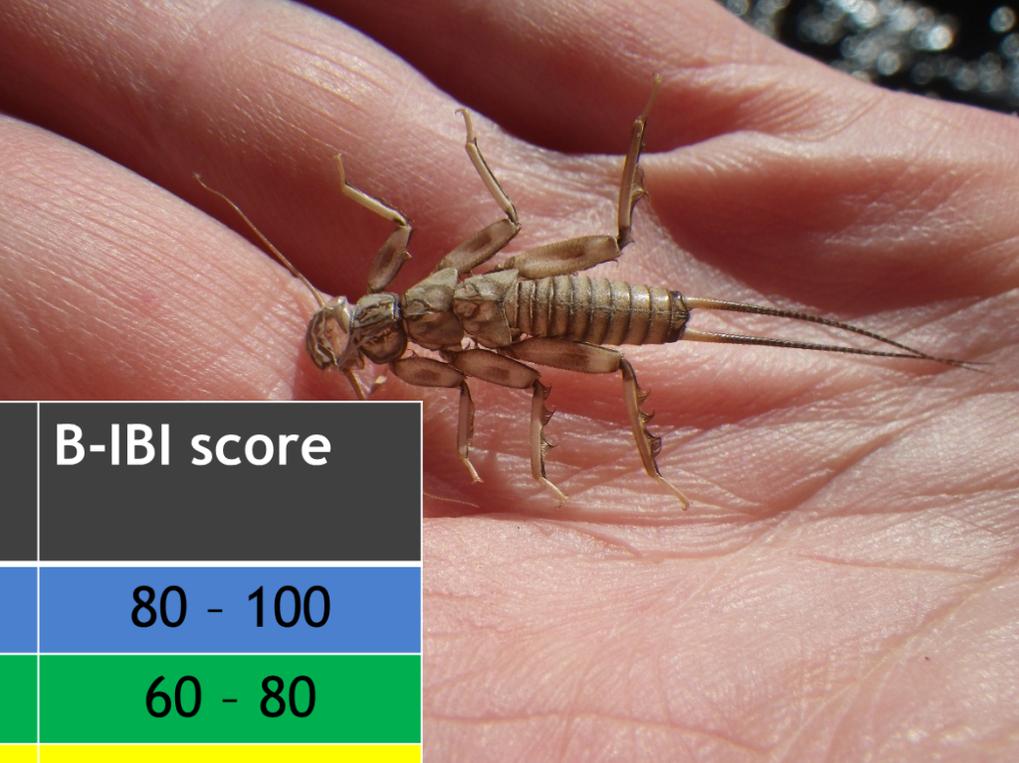


“Stressor Identification and Recommended Actions for Restoring and Protecting Select Puget Lowland Stream Basins”

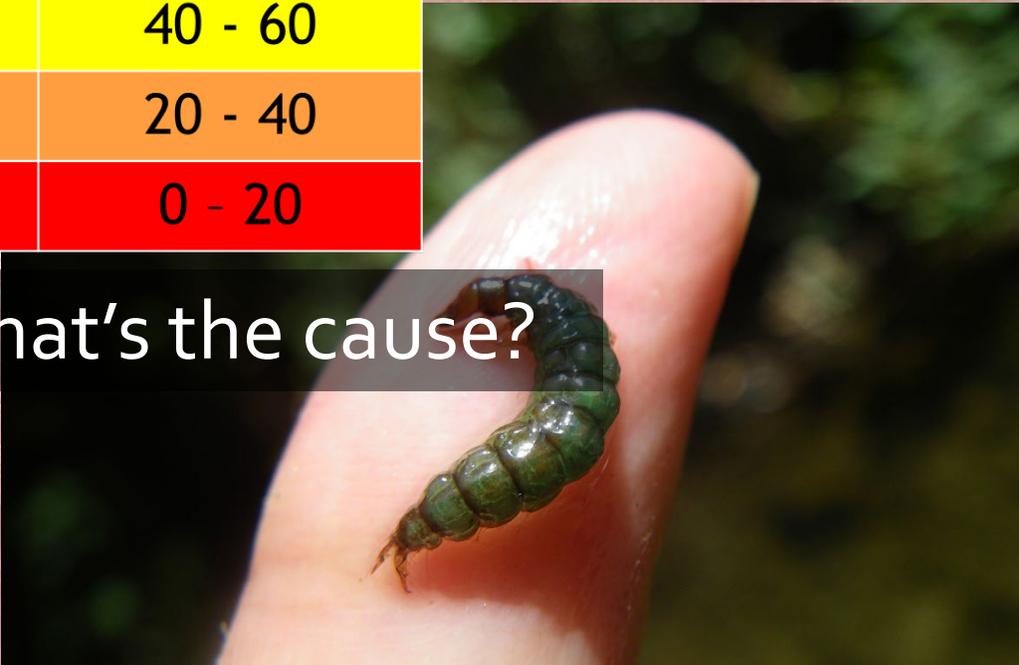


Freshwater Impairments | Benthic Index of Biotic Integrity | Water Quality Index

Puget Sound Partnership Recovery Target



Condition of Biotic Integrity	B-IBI score
Excellent	80 - 100
Good	60 - 80
Fair	40 - 60
Poor	20 - 40
Very Poor	0 - 20



Limitation: What's the cause?

B-IBI Recovery Target

Limitation: What's the cause?

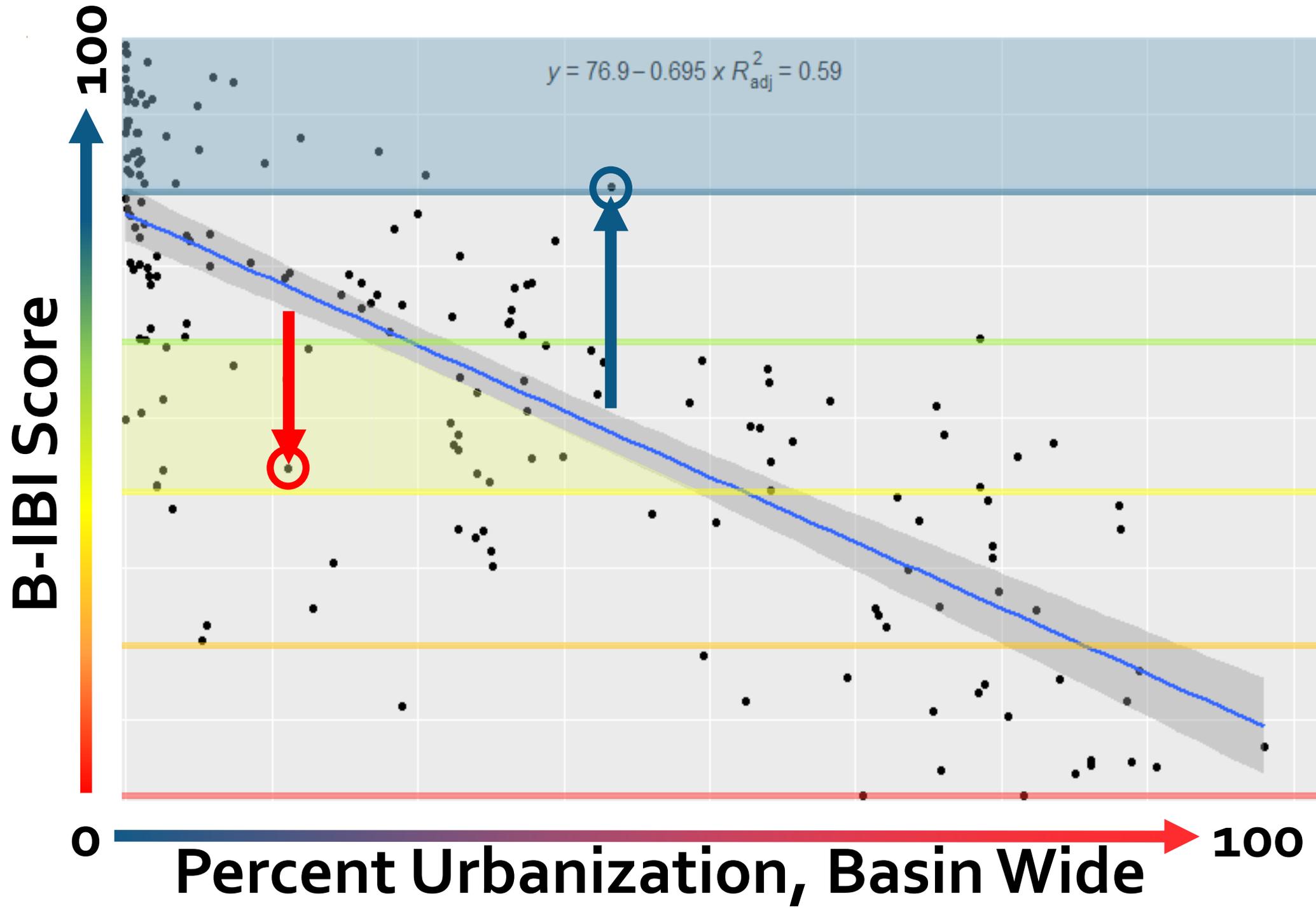
Protect all "Excellent" sites
Restore 30 sites from "Fair" to "Good"



Big Question:



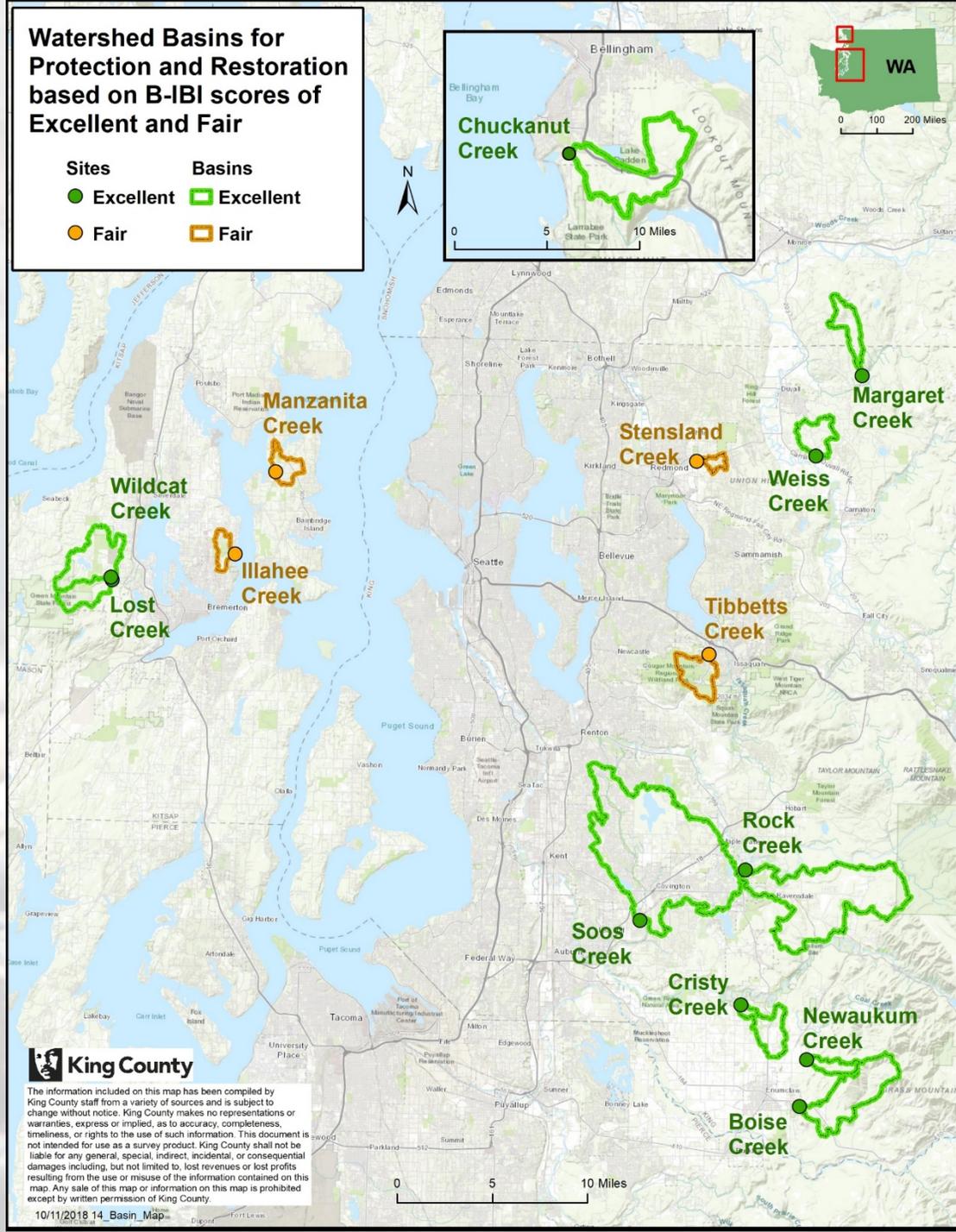
How?



14 basins

Watershed Basins for Protection and Restoration based on B-IBI scores of Excellent and Fair

- | | |
|--------------|---------------|
| Sites | Basins |
| ● Excellent | ■ Excellent |
| ● Fair | ■ Fair |



Approach

What does “Excellent” look like?

Correlate



Determine Thresholds



Identify



Prioritize



Recommend Actions

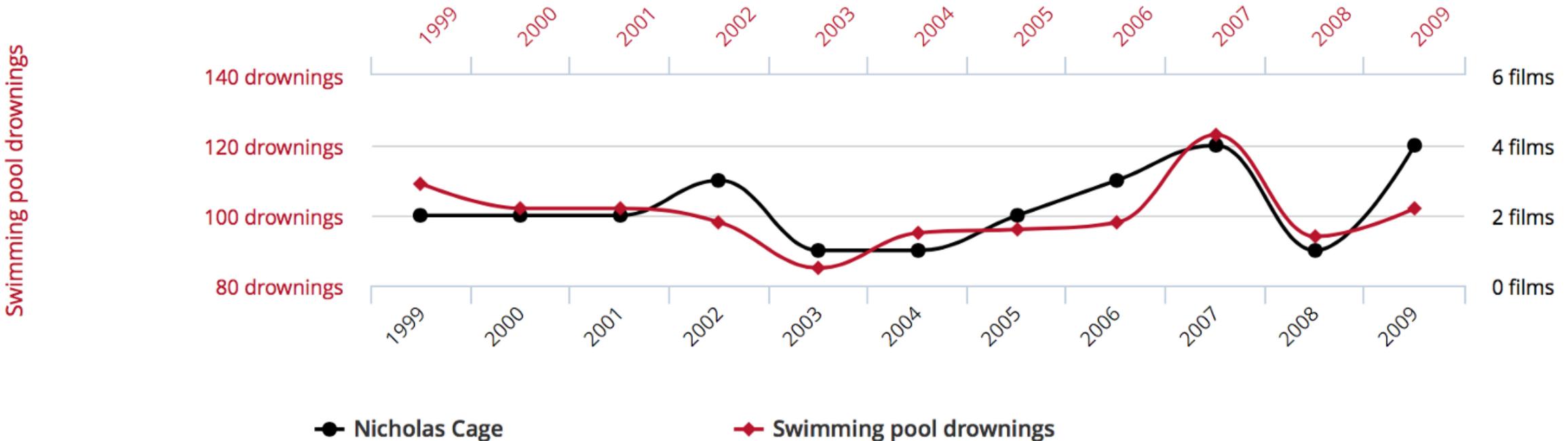
Correlate → Threshold → Identify → Prioritize → Recommend

Number of people who drowned by falling into a pool

correlates with

Films Nicolas Cage appeared in

Correlation: 66.6% (r=0.666004)



Nicholas Cage

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Conditions



Stream bed stability
Embeddedness of stream substrate

Fine sediment in stream channel

Flashiness

Riparian forest health
Basin-wide forest health

Large substrate in stream channel
Organic material in soil

Roads in basin

Local habitat

Low slope

Soil composition in basin

Stream density throughout basin
Stream temperature

Riparian urban development
Basin-wide urban development

Septic Influence

Sinuosity

Timber Harvest



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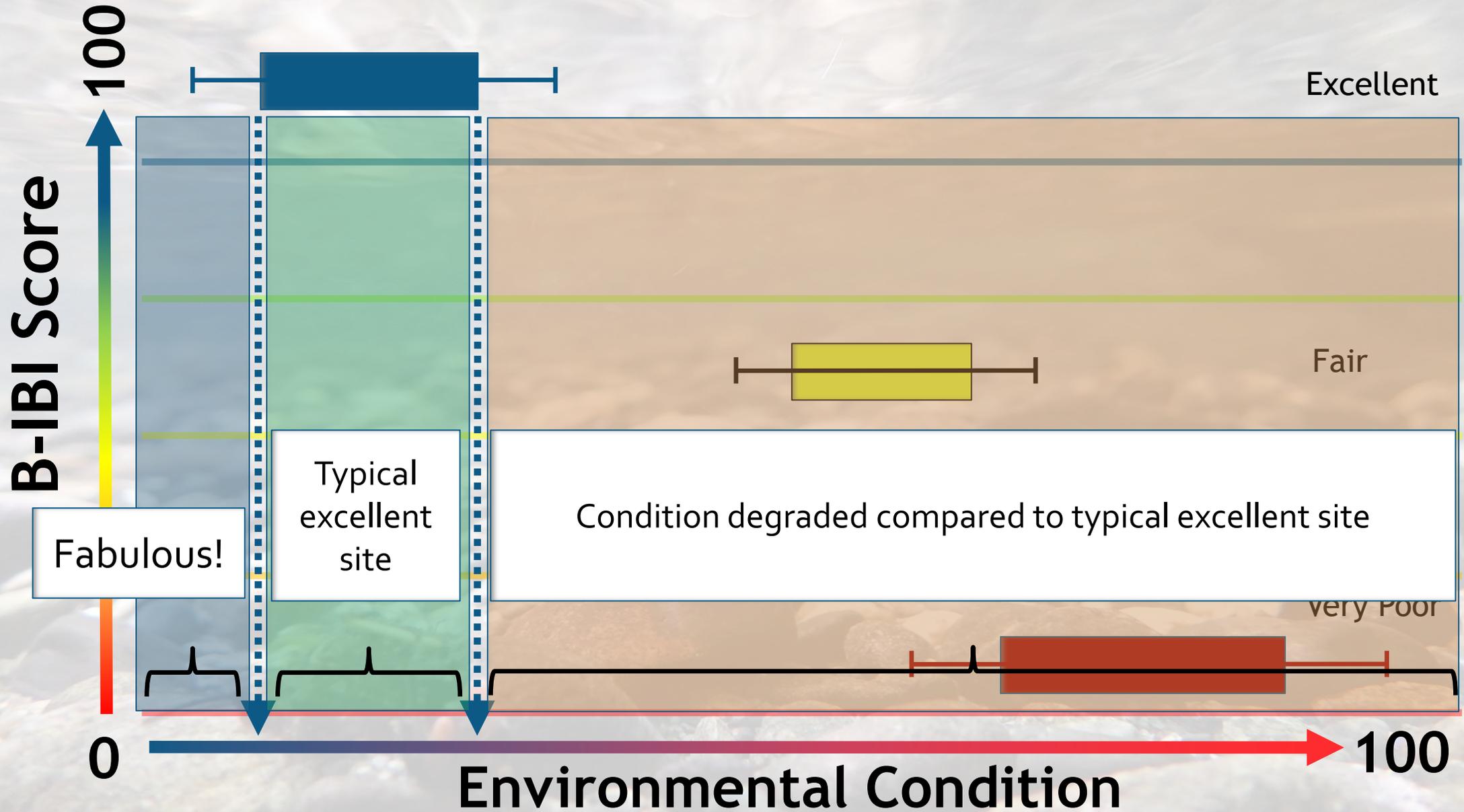
Conditions

Correlate → **Threshold** → Identify → Prioritize → Recommend

Thresholds to characterize Excellent basins

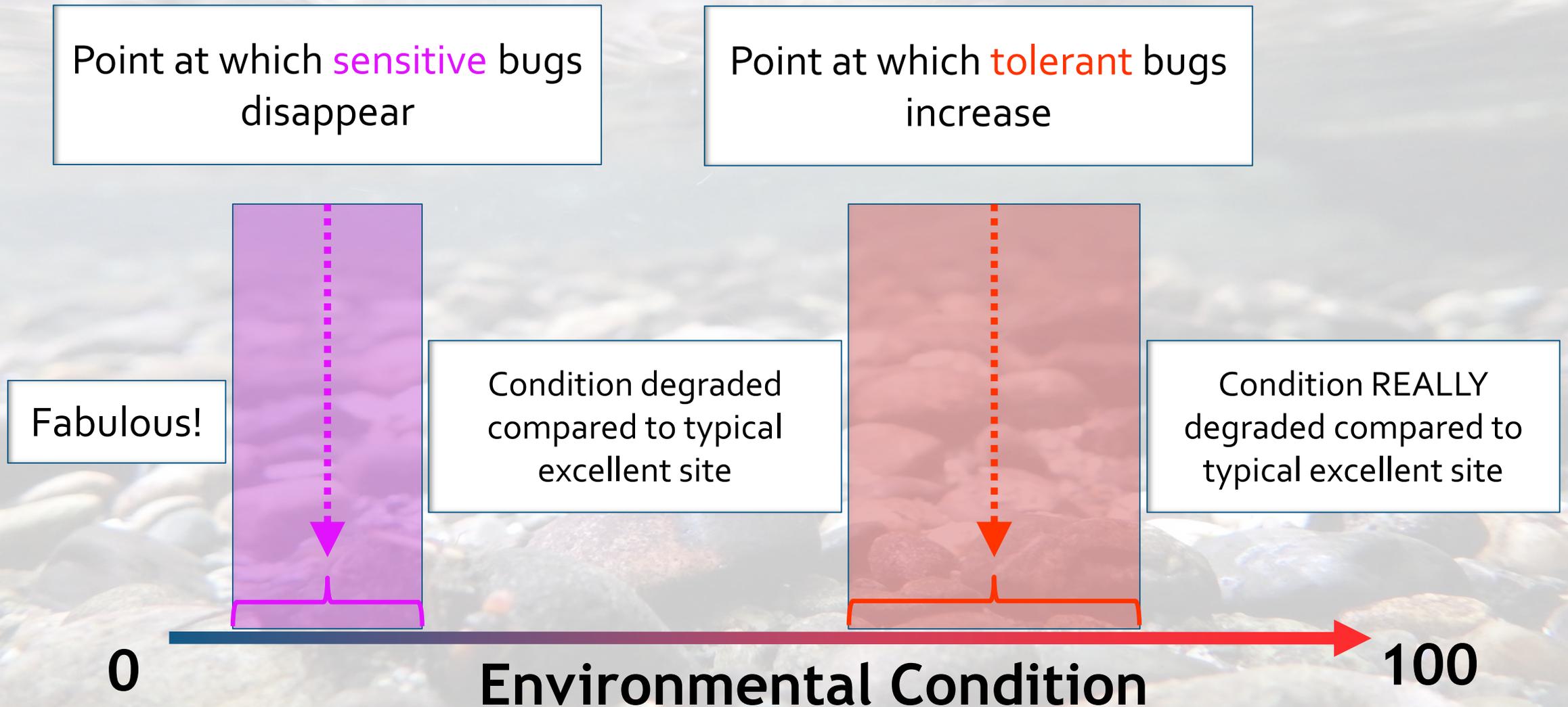
- Two Methods
 - Measure of certainty

Correlate → **Threshold** → Identify → Prioritize → Recommend

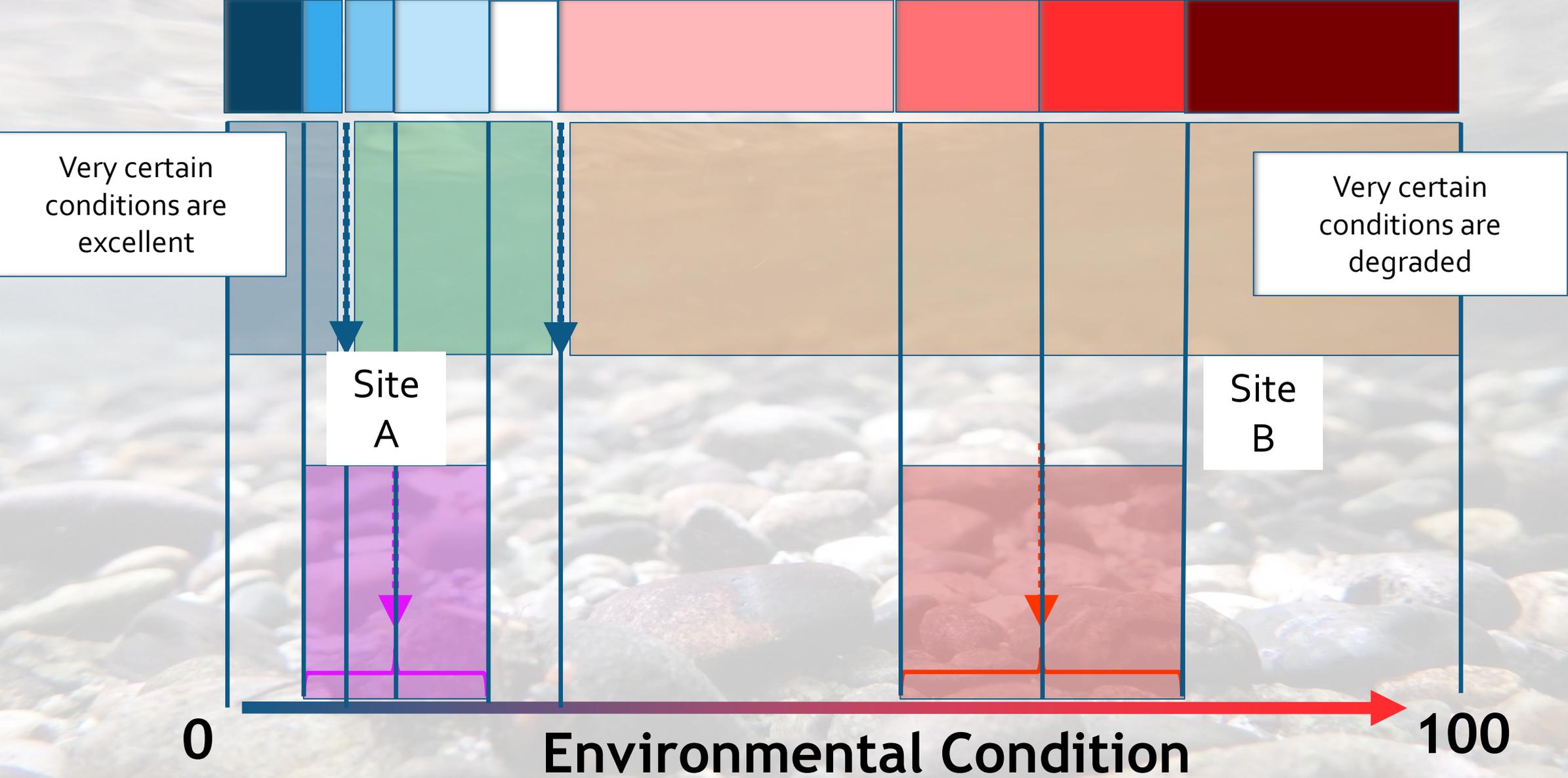


Correlate → **Threshold** → Identify → Prioritize → Recommend

Baker and King 2010



Correlate → Threshold → **Identify** → Prioritize → Recommend



Correlate → Threshold → Identify → **Prioritize** → Recommend

Human Influenced

Stream bed stability
Embeddedness of stream substrate
Fine sediment in stream channel
Flashiness
Riparian forest health
Basin-wide forest health
Large substrate in stream channel
Roads in basin
Local habitat
Stream temperature
Riparian urban development
Basin-wide urban development

Condition	Certainty	Correlation
% Urban	HIGH	HIGH
% Impervious	HIGH	HIGH

Natural

Organic material in soil
Low slope
Soil composition in basin
Stream density throughout basin



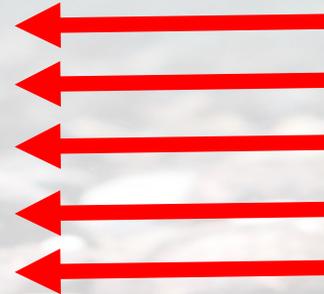
Correlate → Threshold → Identify → **Prioritize** → Recommend

If category is degraded:

Basin-wide urban
development

Recommended Actions

In-stream	Add large substrate
	Stablize stream banks
Riparian Buffer	Stablize slopes
	Plant vegetation, extend buffer
Stormwater Conveyance Systems	Increase stormwater flow control
	Improve stormwater treatment
	Maintain facilities
	Minimize impact of road runoff
Forested Land	Maintain/decomission roads
	Allow existing forest to mature
	Plant vegetation
Agricultural Land	Exclude livestock
	Manage waste
	Prevent soil loss
Mining Areas	Enforce mining BMPs



Correlate → Threshold → Identify → **Prioritize** → Recommend

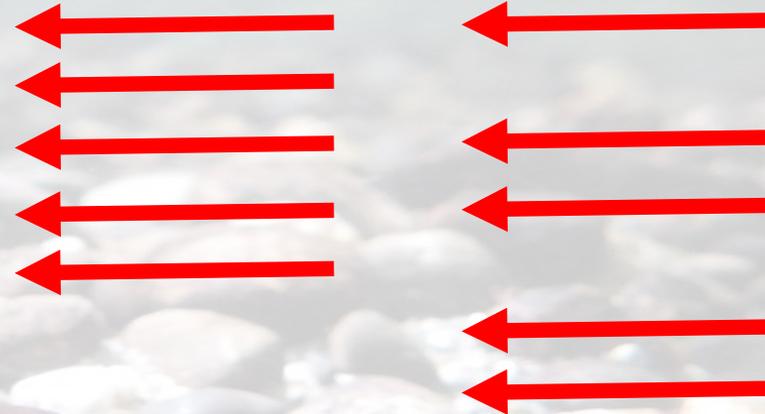
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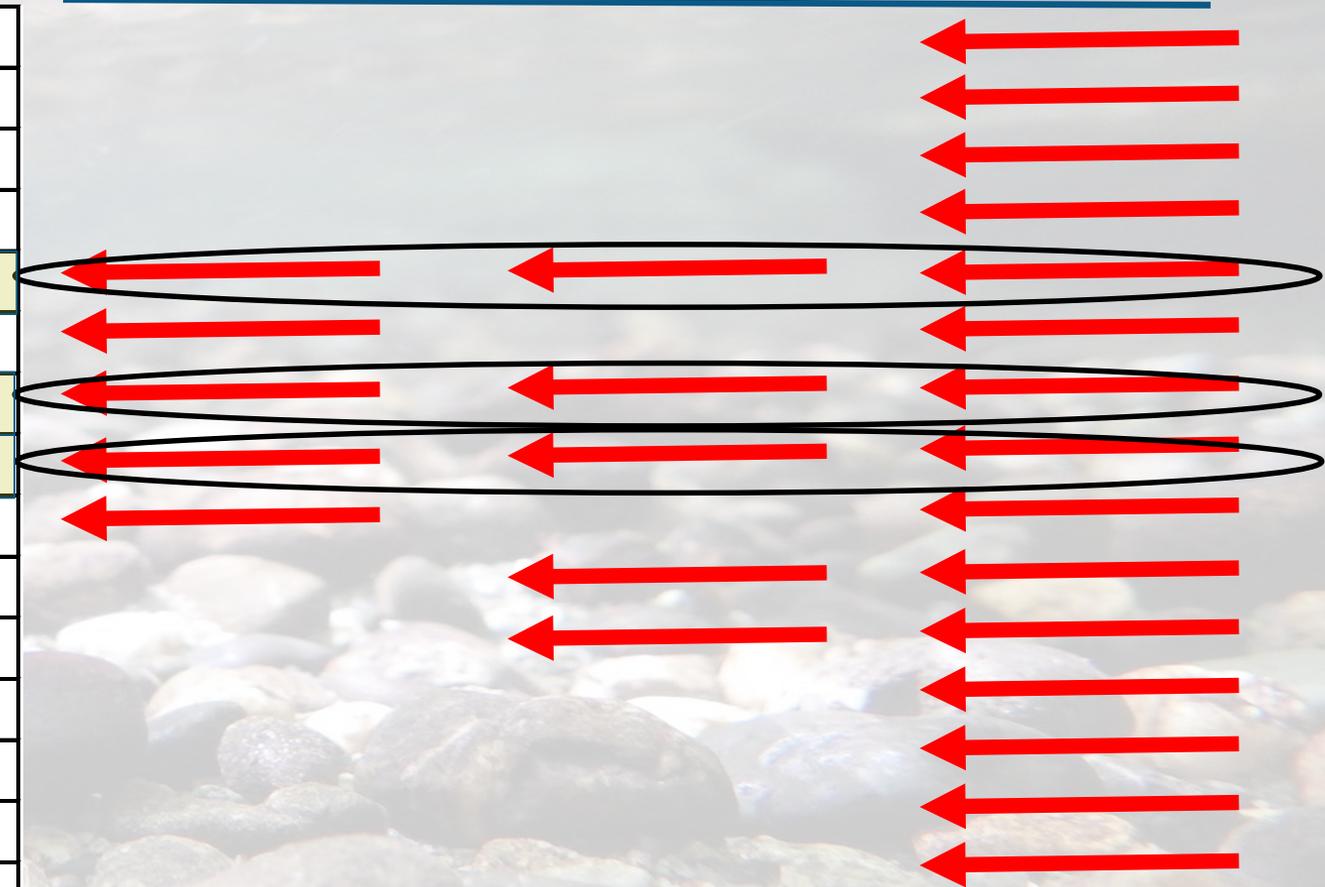
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Basin-wide urban development

Flashiness

Fine sediment



Correlate → Threshold → Identify → Prioritize → **Recommend**

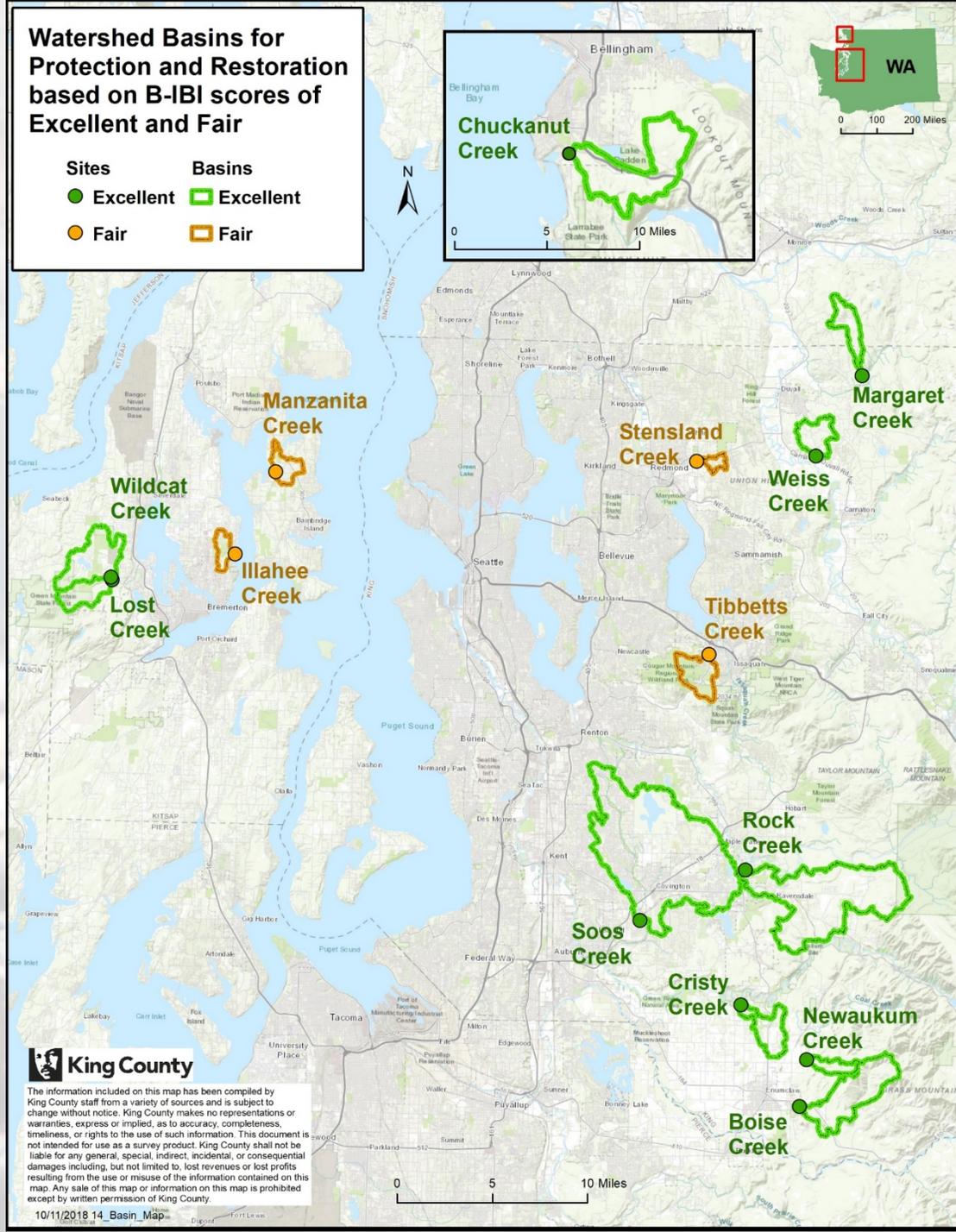
Target Area or Land Use	Management Action	Importance
In-stream	Add large substrate	2.6
	Stablize stream banks	2.5
Riparian Buffer	Stablize slopes	6.6
	Plant vegetation, extend buffer	7.9
Stormwater Conveyance Systems	Increase stormwater flow control	8.0
	Improve stormwater treatment	6.5
	Maintain storage and treatment facilities	8.0
	Minimize impacts of road runoff	8.0
Forested Land	Maintain or decomission forest roads	6.5
	Allow existing forest to mature	7.1
	Plant vegetation	7.1
Agricultural Land	Exclude livestock	3.6
	Manage waste	3.6
	Prevent soil loss	3.6
Mining Areas	Enforce Mining BMPs	2.5

14

basins

Watershed Basins for Protection and Restoration based on B-IBI scores of Excellent and Fair

- | | |
|--------------|---------------|
| Sites | Basins |
| ● Excellent | ■ Excellent |
| ● Fair | ■ Fair |



Conclusions

- **Two methods for determining thresholds: similar results!**
 - **B-IBI works well as integrative measure**
- **Every basin is unique, but face similar stressors**
- **Posters in the back with results from three of the 14 stream basins**
- **Intermediate level of investigation**

Acknowledgements

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King County

Thank you.

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