EPA
United States
Environmental Protection
Agency

Rapid Causal Assessment

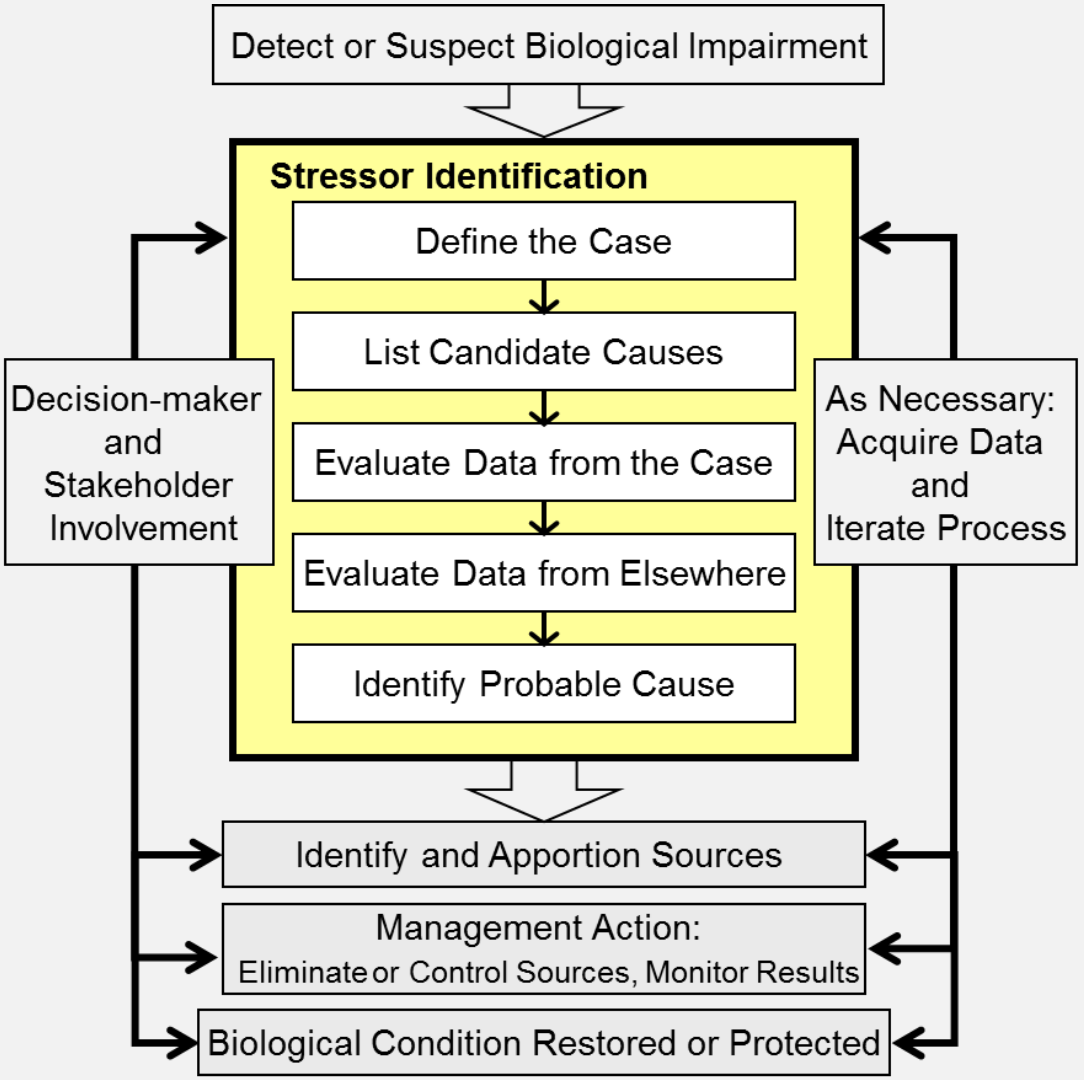
Office of Research and Development
National Center for Environmental Assessment

EPA's Method for Causal Assessment

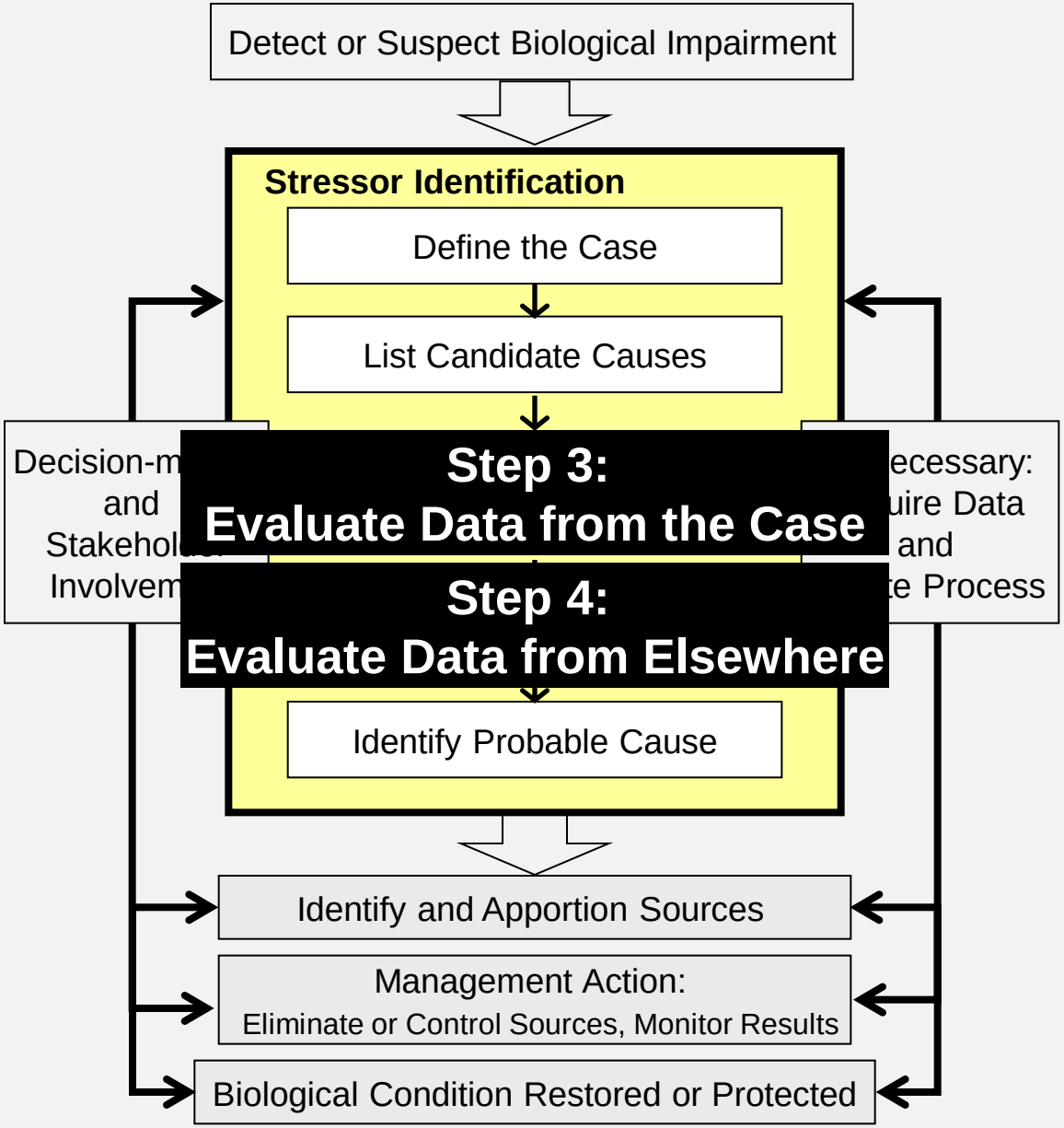
Synopsis

- Identify a set of candidate causes (i.e., alternative hypotheses) that might explain how the adverse effect occurred
- Derive evidence relevant to each candidate cause
  - Field observational studies
  - Laboratory and mesocosm experiments
- Identify the candidate cause(s) that are best supported by the evidence
- References

  www.epa.gov/caddis;
  Norton, S.B., Cormier, S.M., Suter, G.W. II. 2014. *Ecological Causal Assessment.* CRC Press



- Causal assessments benefit from synthesizing many types of evidence
- Downside: deriving evidence is time and resource consuming
- ? How to Streamline?



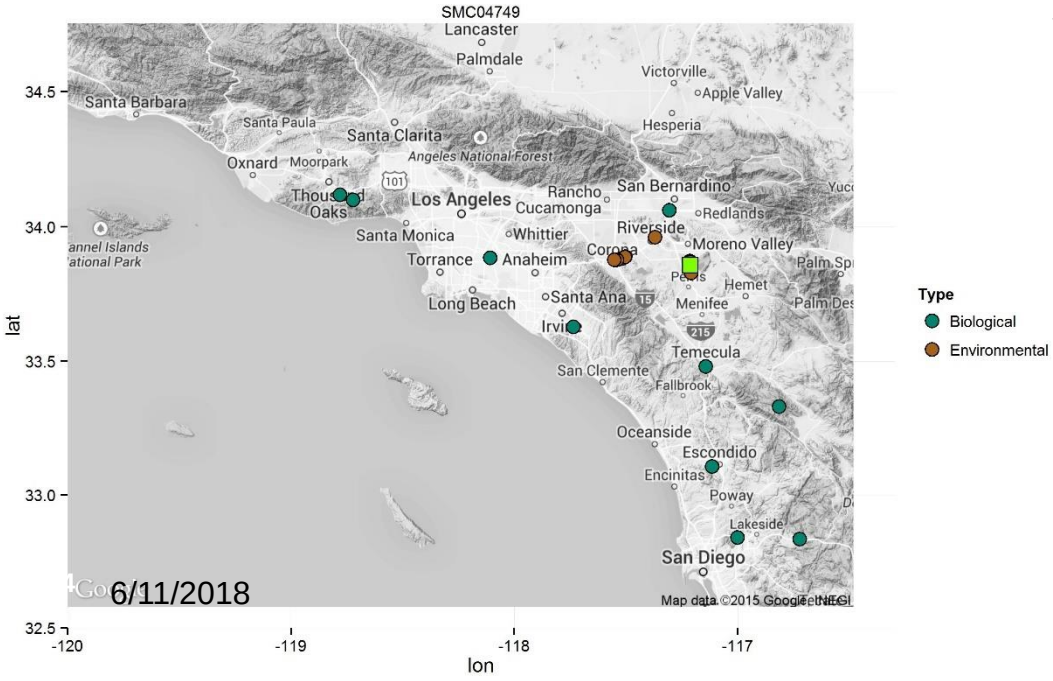
Streamlining Causal Assessment

Goal: Make Stressor ID faster, cheaper, routine

1. Build off of species sensitivity distributions
   - Use to verify that sensitive species are missing, or that extirpation is expected
2. High resolution background models
   - Useful for naturally occurring stressors like conductivity
   - *Coming soon:* Freshwater Explorer Story Map
3. Improve flow of information from research to applied community
   - *Coming soon*: Systematic literature review of nutrient effects on macroinvertebrates, algae, and chl *a* in streams.
4. Better utilize monitoring and watershed datasets
   - Use to streamline comparator site selection

Streamline Comparator Site Selection

- Concept: match test case with a group of sites closely similar in their distribution of naturally confounding factors (e.g., elevation, watershed size).
- Comparator sites ≈ control cases in epidemiological case-control studies.



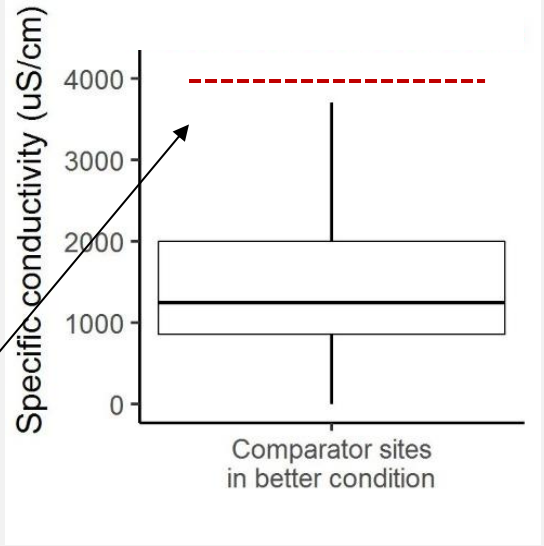
- Method A: Use predicted taxon occurrences (from O/E models) to identify comparator sites that would be expected to be similar to each test site in the absence of human influence
- Method B: Identify clusters of similar streams based on StreamCat abiotic variables
  - Reach characteristics (e.g., lat, long, area)
  - Hydrological characteristics (e.g., baseflow)
  - Climatological characteristics (e.g., temp)
  - Geological characteristics (e.g., soil type)

Data from comparator sites can be used to develop several frequently used types of evidence

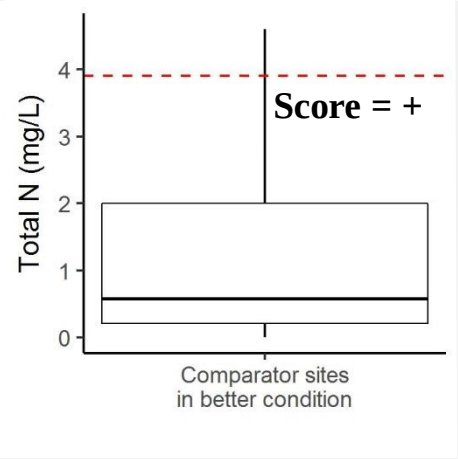
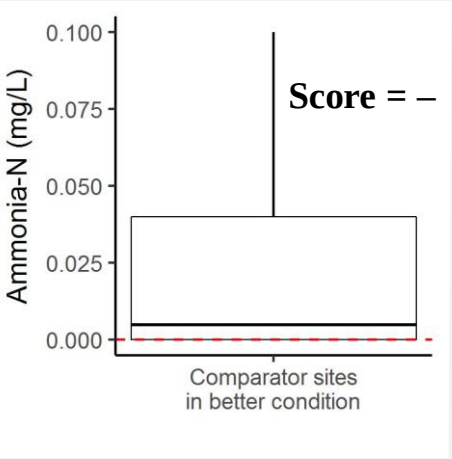
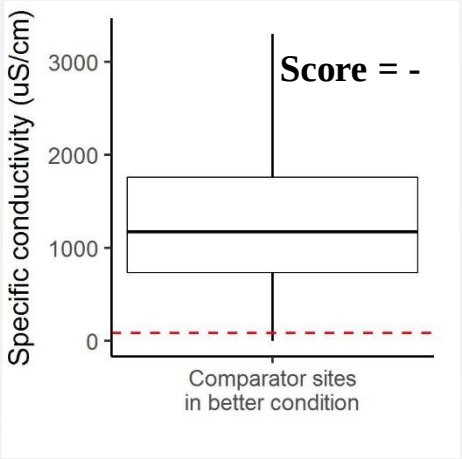
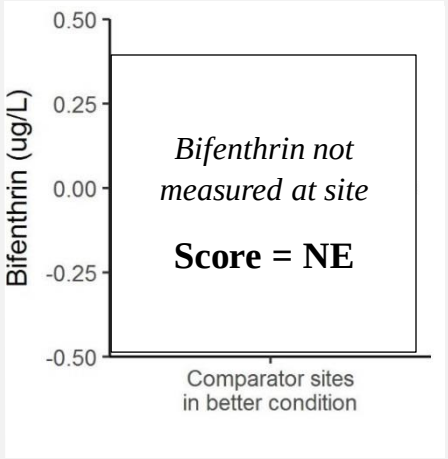
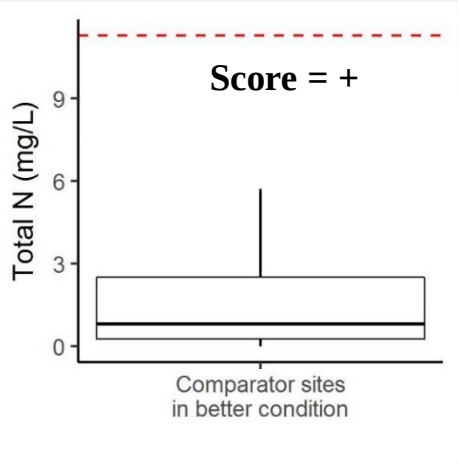
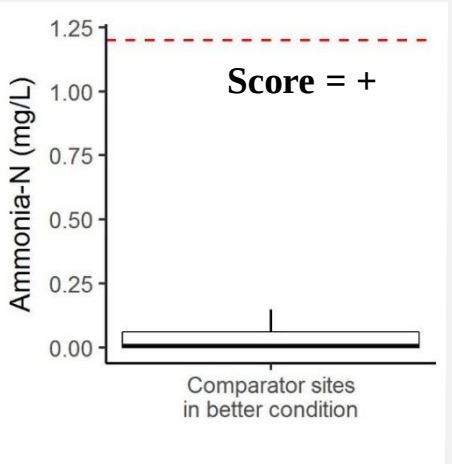
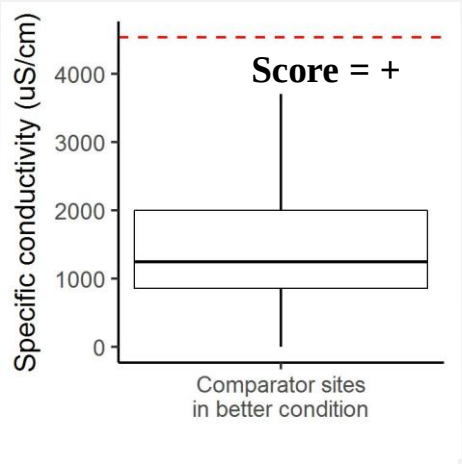
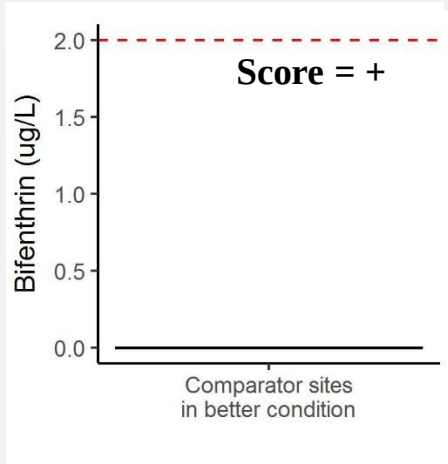
For example,

Spatial/Temporal Co-occurrence: Are higher levels of the stressor observed where and when the biological effect occurs?

- Make box plot showing distribution of stressor levels at comparator sites with better biological condition.
- Plot stressor levels from test site.



Spatial/Temporal Co-occurrence

	Total N (mg/L)	Ammonia N (mg/L)	Specific Conductivity (µS/cm)	Bifenthrin (µg/L)
Site A2				
Site U5				

Rapid Derivation of Evidence for Multiple Sites

Test Site	Total Nitrogen		Ammonia		Specific Conductivity		Bifenthrin	
	Co-Occurrence	Stressor Response	Co-occurrence	Stressor Response	Co-occurrence	Stressor Response	Co-occurrence	Stressor Response
A1	NE	NE	–	–	0	0	NE	NE
A2	+	+	–	–	–	–	NE	NE
A3	+	–	–	–	+	–	+	–
R1	–	–	–	–	0	0	–	–
R2 §	–	0	+	0	+	0	NE	NE
R3	+	–	–	–	NE	NE	–	–
U1	+	+	+	+	–	0	NE	NE
U2	–	–	–	–	0	+	–	–
U3	–	–	NE	NE	+	+	NE	NE
U4	–	–	–	–	+	+	–	–
U5	+	+	+	+	+	+	+	0
U6	NE	NE	NE	NE	–	0	NE	NE
U7	0	0	0	0	–	0	–	–
U8	NE	NE	NE	NE	NE	NE	NE	NE
U9	–	–	0	–	0	+	–	–