



Causal Assessment Screening Tool

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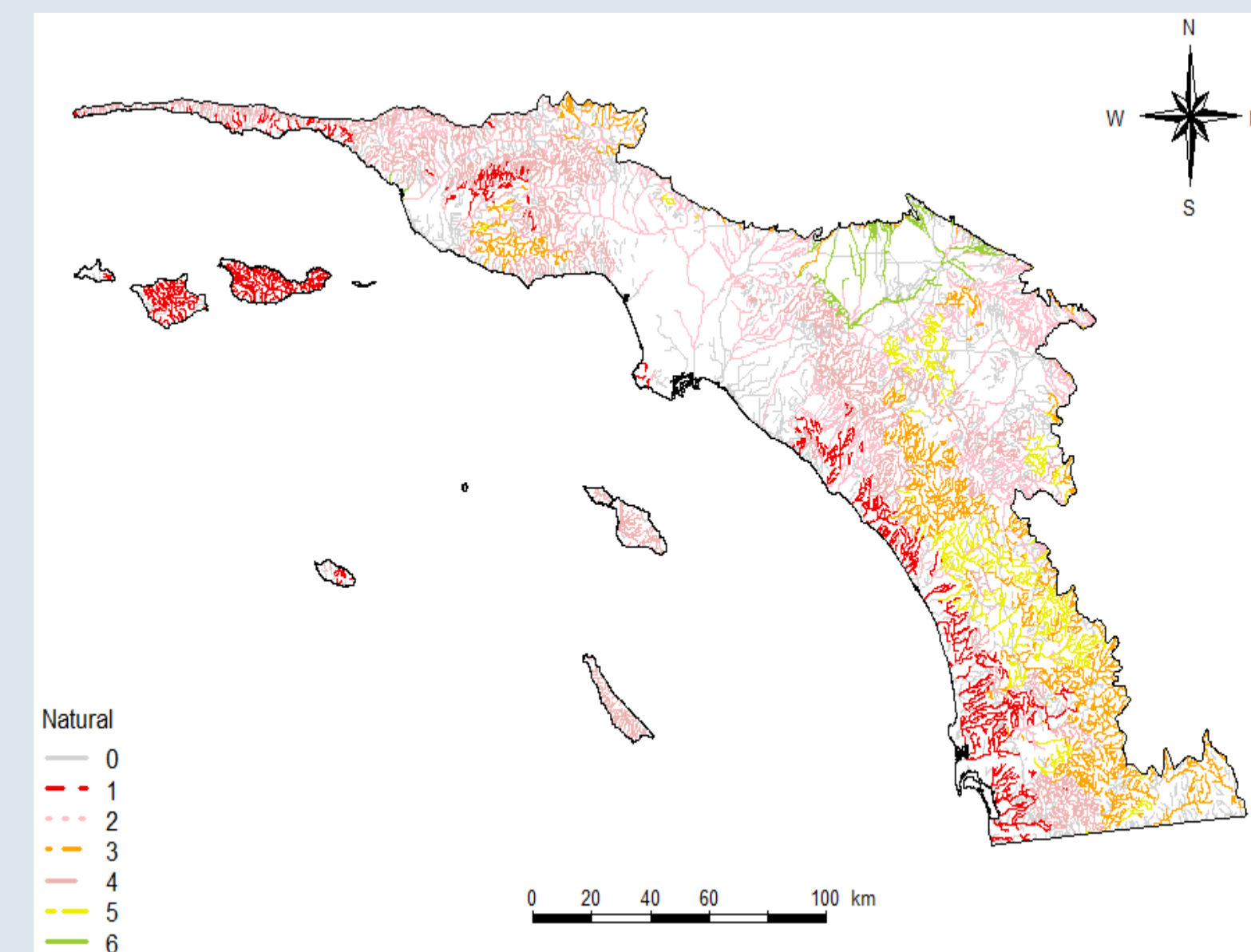
BACKGROUND

The Causal Assessment Screening Tool (CAST) approach is based on USEPA's Causal Analysis/Diagnosis Decision Information System (CADDIS) and lessons learned from recent causal assessment efforts. As an R-based web application, the tool currently focuses on the major lines of evidence that can be routinely evaluated using existing, curated biological monitoring data. The tool ranks the relative certainty of potential stressors as causes of observed biological impairment at a site, and helps prioritize where substantial improvement in biological condition is possible based on the stressors identified. Planned future refinement to CAST would also evaluate recovery potential ("ecological lift") and help identify high quality sites that may be vulnerable to stressors and would benefit from increased protection efforts.

STEP 1: This step gathers relevant available information to present an overall picture of the site, including its setting (location, catchment size, land cover characteristics), pre-determined reference or geomorphological modification status, 303(d) listing status, and chemical or biological sample availability. An ecoregion-scale map locates the site in space. One or more comparator sites for each target site are identified based on pre-clustered stream reaches.

Gather site & cluster information

- Identify target site(s)
- Identify cluster membership
- Determine sample availability
- Determine site & cluster characteristics

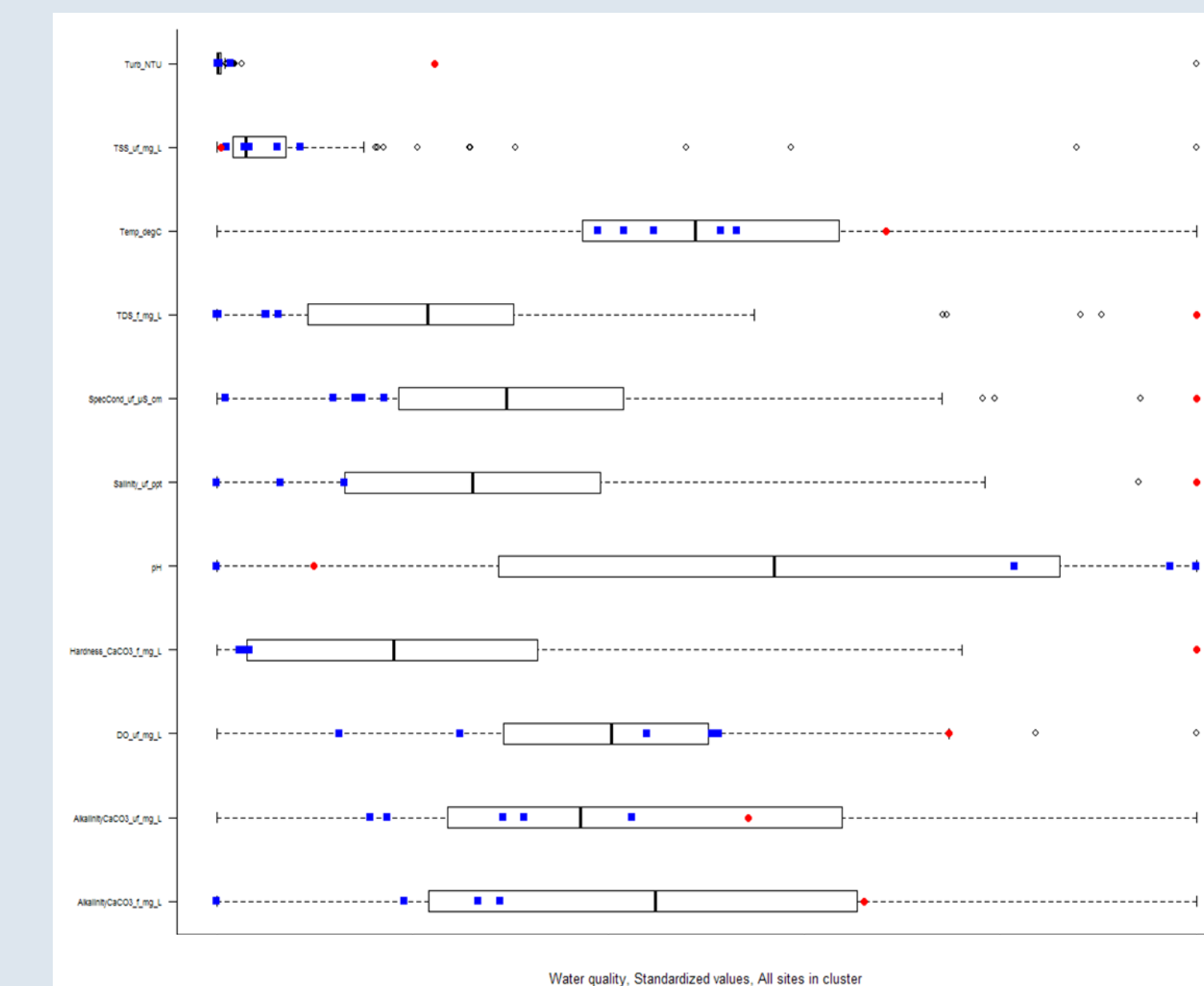


Stream reaches within each ecoregion are clustered based on abiotic parameters such that reaches within a cluster are expected to have similar biological communities under natural conditions. Sites belonging to the same cluster can then be used as comparator sites.

STEP 2: The CAST compares the target site to sites in the same cluster to list potential causes of impairment (stressors). Box plots indicate the distribution for each possible cause; red points depict target site data and blue depict reference site data. The potential causes at the target site are listed based on their relationship to the rest of the cluster data.

List Candidate Causes

- Compare site stressor data to distribution of stressor in cluster
- Use percentile rank cut-off values to identify candidates for further analysis



Stressor and response data are drawn from existing public datasets. Each dataset is curated before being incorporated into the CAST. Stressor and response data will vary depending on the data availability and reliability. The tool has been built to evaluate any manner of numerical chemical or physical habitat data, and any response data including algae, benthic macroinvertebrates, or fish.

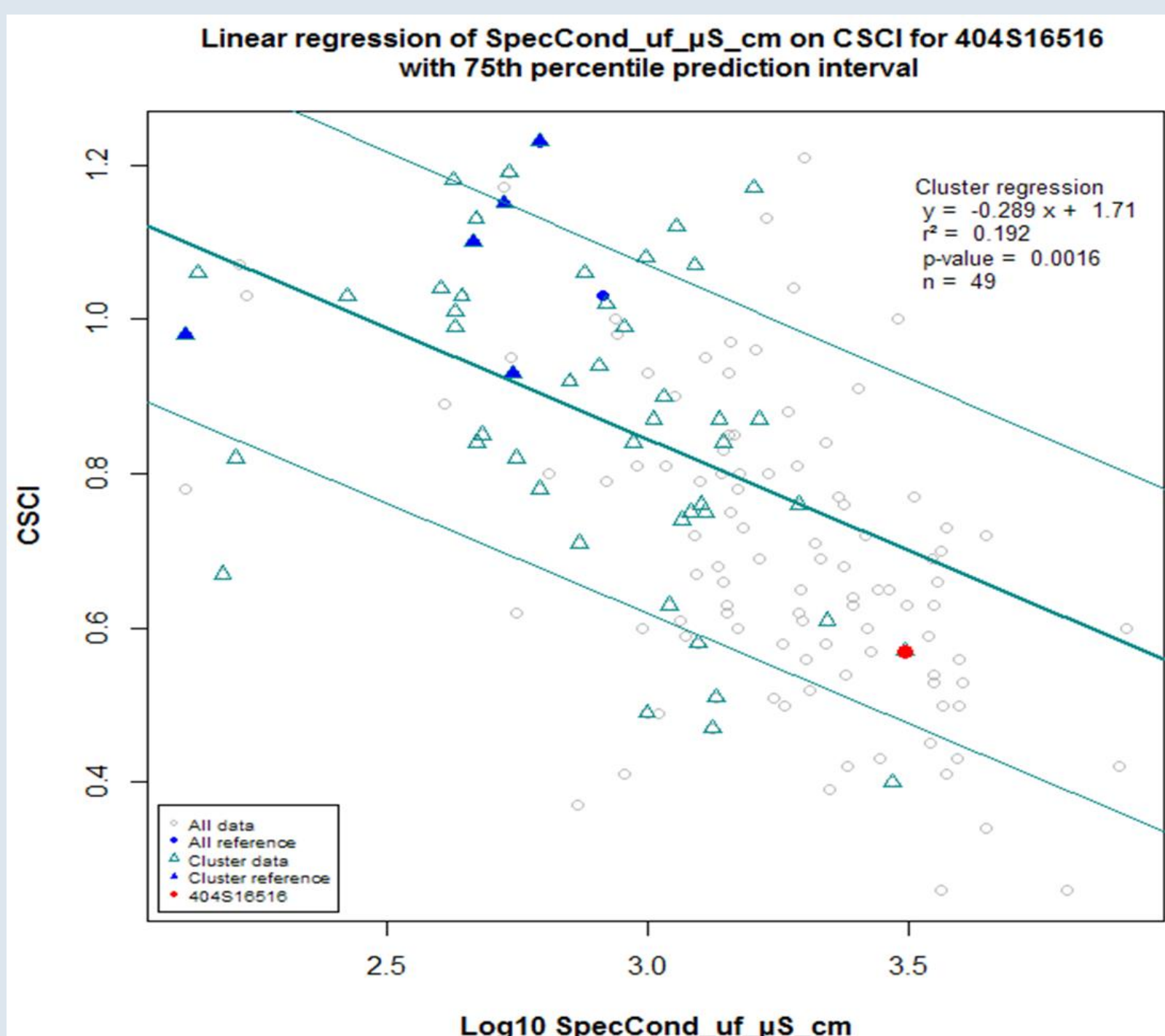
STEP 3: A number of analyses can be used to evaluate whether the potential stressors might cause the impairment. Regression analysis provides metrics for evaluating support for or against a biological gradient. Stressors-specific diagnostic analyses are used as appropriate.

Evaluate Data

- Regression analysis with prediction intervals
- Present all sites, cluster sites, reference sites, target site
- Provide stressor-specific analysis, if available

Stressor-specific tolerance values can be incorporated into the analysis. Specifically, the relative abundances of tolerant and sensitive organisms can be related to stressor data to provide additional diagnostic capabilities.

Species-sensitivity distributions, where available, also shed light on the potential for impairment caused by particular stressors.



STEP 4: Results are generalized to indicate supporting, refuting, and equivocal evidence. Not all lines of evidence in CADDIS are evaluated. A summary report presents the findings, and a detailed report presents graphics and metrics for each step of the process.

Upcoming work will include incorporating a narrative explanation of the findings, to assist the user in interpreting the results.

Causal Considerations	Conductivity			TSS			Turbidity		
	CSCI	% EPT	% intol	CSCI	% EPT	% intol	CSCI	% EPT	% intol
Co-occurrence (spatial & temporal)	↑	↑	↑	↑	↑	↑	↓	↓	↓
Biological Gradient	↑	↑	↓	↑	↑	↓	↑	↑	↓
Consistency of Association	↑	↑	↑	↑	↑	↑	↑	↑	↑

PLANNED IMPROVEMENTS

- Incorporate additional data, enhance stressor-specific data
- Continue evaluating comparator site approach
- Expand approach to allow multiple site analysis
- Add data gap analysis
- Determine best cutoffs for candidate cause identification
- Refine methods for evaluating stressor-response relationships
- Summarize and "score" results
- Add in "advanced user" options
- Recovery potential/protection prioritization modules