

The California Stream Condition Index (CSCI)

December 2015

WHAT IS THE CALIFORNIA STREAM CONDITION INDEX?

The California Stream Condition Index (CSCI) is a biological scoring tool that helps aquatic resource managers translate complex data about benthic macroinvertebrates found living in a stream into an overall measure of stream health. The CSCI score indicates whether, and to what degree, the ecology of a stream is altered from a healthy state. Direct measures of ecosystem health like the CSCI are preferable to those based on chemical or physical measurements for many management questions. Living organisms integrate the effects of multiple stressors, such as sedimentation, nutrient enrichment and riparian disturbance, over both space and time.



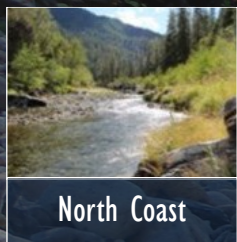
Benthic macroinvertebrates are small but visible invertebrates, such as insect larvae, that live on stream bottoms. Flathead mayfly larva pictured left.

STATEWIDE REFERENCE SITES

Reference sites where human disturbance is absent or minimal are used to set benchmark expectations for healthy streams. A large set of nearly 600 reference sites (**see map**), representing the broad diversity of natural stream types found across California, was used to develop the CSCI.

CSCI vs. IBIs

Indices of biotic integrity (IBIs) were previously available for some regions of California. The CSCI is an advancement over previous indices because it is applicable statewide, accounts for a much wider range of natural variability, and provides equivalent scoring thresholds in all regions of the state. Additionally, the CSCI provides multiple lines of evidence, incorporating measures of species composition and ecological traits into a single condition score.



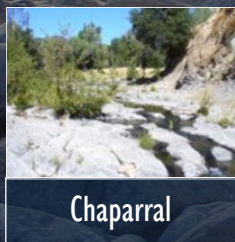
North Coast



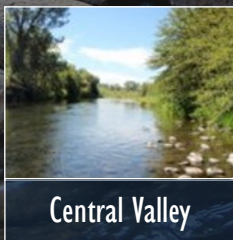
Desert-Modoc



Sierra Nevada



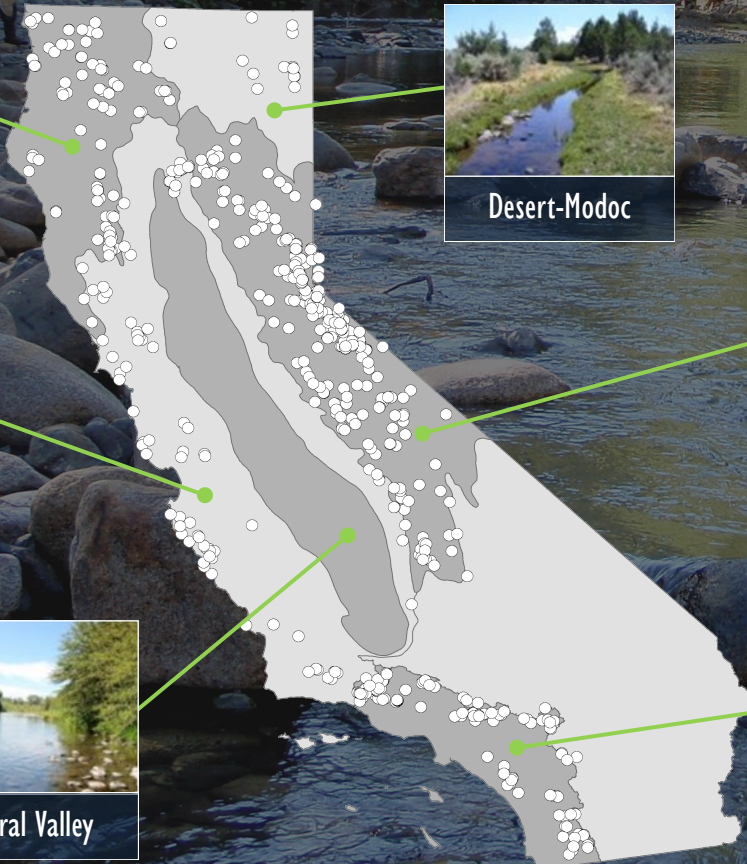
Chaparral



Central Valley



South Coast



HOW IS THE CSCI SCORE CALCULATED?

The CSCI score is a measure of how well a site's **observed** condition matches its predicted, or **expected**, condition. Expected values of a set of **ecological indicators** are predicted using statistical models. Predictions are based on natural environmental variables resulting in a site-specific prediction for each site; greater deviations from this expectation indicate a greater likelihood of degradation. The CSCI score is calculated by comparing the expected condition with actual (observed) results. CSCI scores range from 0 (highly degraded) to greater than 1 (equivalent to reference).

EXPECTED



Natural environmental variables are used to predict the biological composition (species and their ecological traits) at a site if it's healthy.

OBSERVED



The site is sampled and species are identified in the lab.



Observed Species and Traits

Expected Species and Traits

= CSCI Score

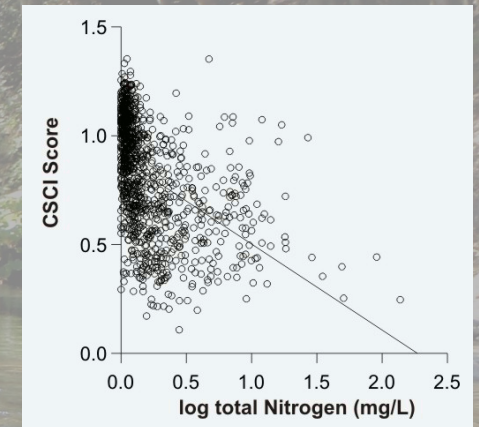
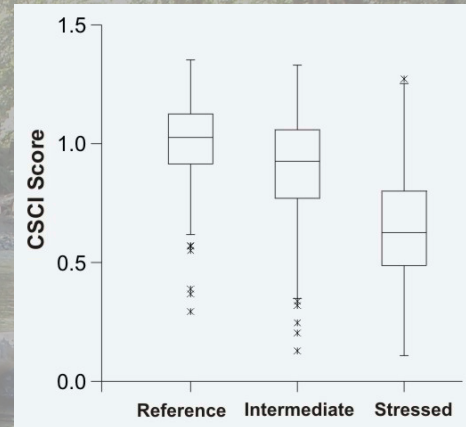
CSCI Components

Taxonomic Completeness	Species
	# Species
Measures of ecological traits (structure and function)	# Shredders
	% Clingers
	% Coleoptera
	% EPT *
	% Intolerant

*EPT = Ephemeroptera + Plecoptera + Trichoptera

HOW CAN THE CSCI BE USED?

The CSCI can be used to assess the status and trends of stream condition at multiple scales (sites, watersheds, regions, and statewide) and is also well-suited for compliance monitoring, evaluating the success of mitigation and restoration projects, and evaluating the success of stream protection policies and programs. It is an integral component of the state's bio-integrity plan. The CSCI is useful for measuring biological integrity in wadeable perennial and non-perennial streams throughout California. The limits of the CSCI's applicability in streams that are dry for more than 6 months each year are currently being researched by SWAMP and several regional partners.



The CSCI is responsive to human disturbance and discriminates well between reference sites and "stressed" sites, that is, sites with high levels of overall human activity in the watershed. The CSCI also responds well to individual stressor gradients such as total nitrogen, a nutrient closely associated with eutrophication in streams and rivers.

THE CSCI IS CURRENTLY BEING USED TO:

- Assess regional and statewide stream condition
- Identify healthy streams and prioritize them for protection
- Identify impaired streams and prioritize them for restoration
- Evaluate effectiveness of stormwater best-management practices
- Assess the impacts of timber harvest activities

For additional information on applications of the CSCI and guidance on how to calculate it, contact Lori Webber (Lori.Webber@waterboards.ca.gov) or Calvin Yang (Calvin.Yang@waterboards.ca.gov).

More information can also be found at the SWAMP Bioassessment Program [website](http://www.swamp.org).

