

# California's Surface Water Ambient Monitoring Program

## Using an Interactive Dashboard to Communicate Bioassessment Data

Science Symposium  
June 21, 2018



**Calvin Yang**  
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*SWAMP/OIMA*



# SWAMP Mission

**Provide resource managers, decision makers, and the public with timely, high-quality information to evaluate the condition of all waters throughout California.**

SWAMP monitoring evaluates the physical, chemical, and biological integrity of the State's waters.

**Ephemeroptera**  
(mayflies)



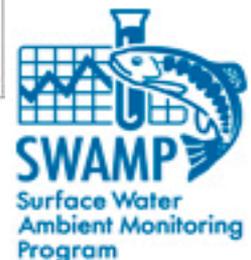
**Plecoptera**  
(stoneflies)



**Trichoptera**  
(caddisflies)

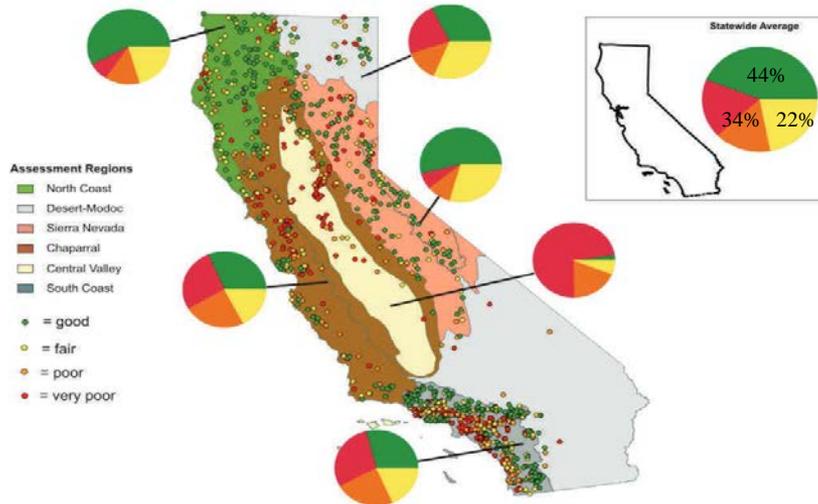


Courtesy of “Bugs to Go” on the SWAMP Bioassessment Website  
[https://www.waterboards.ca.gov/water\\_issues/programs/swamp/bioassessment/](https://www.waterboards.ca.gov/water_issues/programs/swamp/bioassessment/)



# Ambient and Reference Monitoring Programs Provide Context for Assessment

Perennial Streams Assessment  
(status of streams using statistical survey design)



Reference Condition Management Program  
(streams with minimal human disturbance)



# Available Bioassessment Data



**RESULT CATEGORY:**

- Water Quality
- Toxicity
- Tissue
- Benthic
- Habitat



Surface Water – Benthic Macroinvertebrates – CEDEN

California State Water Resources Control Board

Water

Data collected for marine benthic infauna, freshwater benthic macroinvertebrate (BMI), algae, bacteria and diatom taxonomic analyses, from the California Environmental Data Exchange Network (CEDEN). Note bacteria single species concentrations are...

CSV PDF

## Benthic

Project	CollectionMethodName	FinalID	BAResult
Statewide Perennial Streams Assessment 2015	BMI_Reach-WideBenthos	Oligochaeta	193
Statewide Perennial Streams Assessment 2015	BMI_Reach-WideBenthos	Amphipoda	137
Statewide Perennial Streams Assessment 2015	BMI_Reach-WideBenthos	Chironomus	52
Statewide Perennial Streams Assessment 2015	BMI_Reach-WideBenthos	Hyaella	41
Statewide Perennial Streams Assessment 2015	BMI_Reach-WideBenthos	Crangonyx	39



## Habitat



Project	LocationCode	Result	Analyte
Statewide Perennial Streams Assessment 2015	TransI, CtrViewLeft	17	Canopy Cover
Statewide Perennial Streams Assessment 2015	TransI, CtrViewUp	16	Canopy Cover
Statewide Perennial Streams Assessment 2015	TransJ, CtrViewLeft	17	Canopy Cover

## Water Quality

Project	Analyte	Unit	Result
Statewide Perennial Streams Assessment 2015	SpecificConductivity, Total	uS/cm	1574
Statewide Perennial Streams Assessment 2015	Nitrogen, Total, Total	mg/L	0.496
Statewide Perennial Streams Assessment 2015	Phosphorus as P, Total	mg/L	0.0311

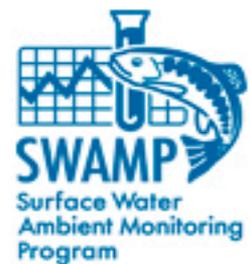
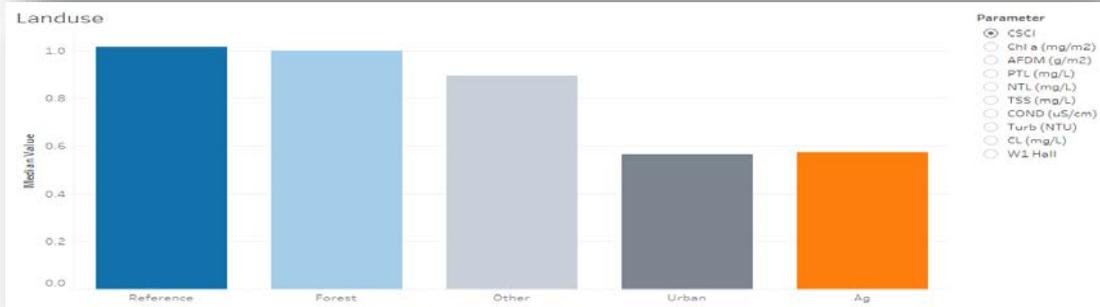


# Dashboard: Data Information

Project	CollectionMethodName	FinalID	BAResult
Statewide Perennial Streams Assessment 2015	BMI_Reach-WideBenthos	Oligochaeta	193
Statewide Perennial Streams Assessment 2015	BMI_Reach-WideBenthos	Amphipoda	137
Statewide Perennial Streams Assessment 2015	BMI_Reach-WideBenthos	Chironomus	52
Statewide Perennial Streams Assessment 2015	BMI_Reach-WideBenthos	Hyaella	41
Statewide Perennial Streams Assessment 2015	BMI_Reach-WideBenthos	Crangonyx	39

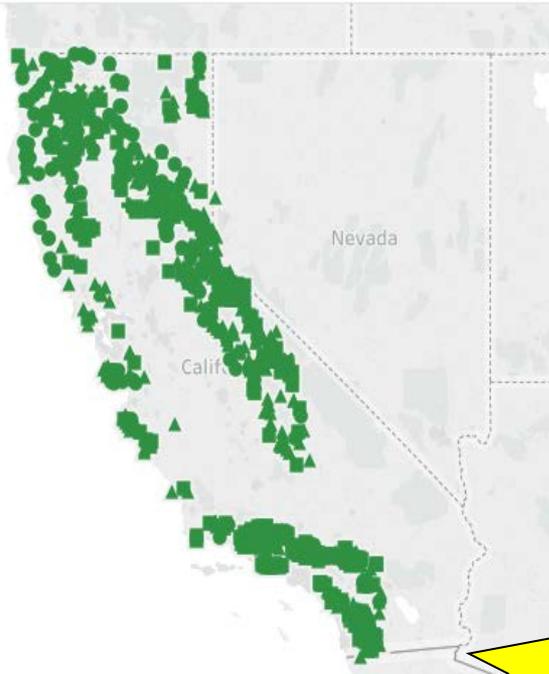


	Number of Results	Minimum	Median	Average	Maximum
CSCI	2,845	0.11	0.95	0.90	1.40
Chl a (mg/m2)	1,714	0.00	10.61	25.16	566.10
AFDM (g/m2)	1,510	0.00	9.09	25.51	840.08
PTL (mg/L)	1,732	0.00	0.02	1.81	1,500.00
NTL (mg/L)	1,513	0.00	0.17	1.11	136.65
TSS (mg/L)	1,381	-0.40	1.90	8.52	700.00
COND (uS/cm)	1,936	0.00	230.40	590.41	31,650.00
Turb (NTU)	1,568	0.00	0.96	3.65	680.00
CL (mg/L)	1,593	0.00	5.63	65.67	9,730.00
W1_Hall	1,602	0.00	0.36	0.96	10.50



# Where are the Intact Biological Streams?

Landuse and CSCI Condition



**CSCI Condition**  
 Likely Intact

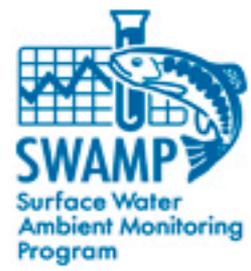
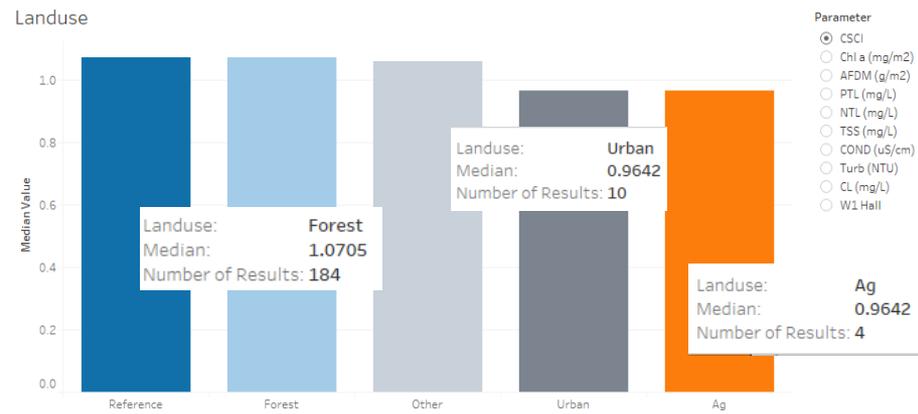
**Landuse**  
 Reference  
 Forest  
 Other  
 Urban  
 Ag

**Reference/Probabilistic**  
 (All)  
 Probabilistic  
 Reference

**Landuse**  
 (All)

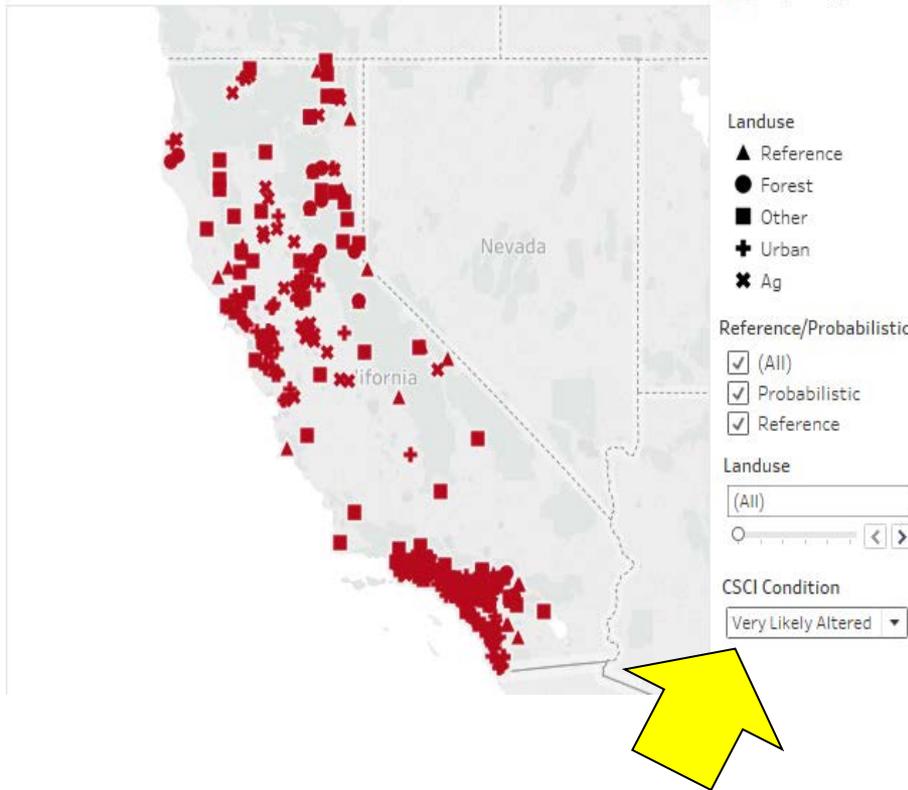
**CSCI Condition**  
 Likely Intact

	Number of Results	Minimum	Median	Average	Maximum
CSCI	1,578	0.92	1.07	1.07	1.40
Chl a (mg/m2)	914	0.00	8.03	14.58	315.38
AFDM (g/m2)	784	0.00	6.54	14.14	704.62
PTL (mg/L)	928	0.00	0.02	0.29	160.00
NTL (mg/L)	767	0.00	0.10	0.33	26.00
TSS (mg/L)	687	-0.30	1.20	2.87	68.00
COND (uS/cm)	1,006	0.00	144.80	283.67	2,763.00
Turb (NTU)	851	0.00	0.67	1.48	85.20
CL (mg/L)	825	0.00	1.84	13.73	460.00
W1 Hall	750	0.00	0.09	0.35	4.31



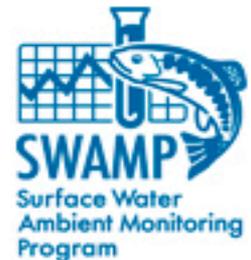
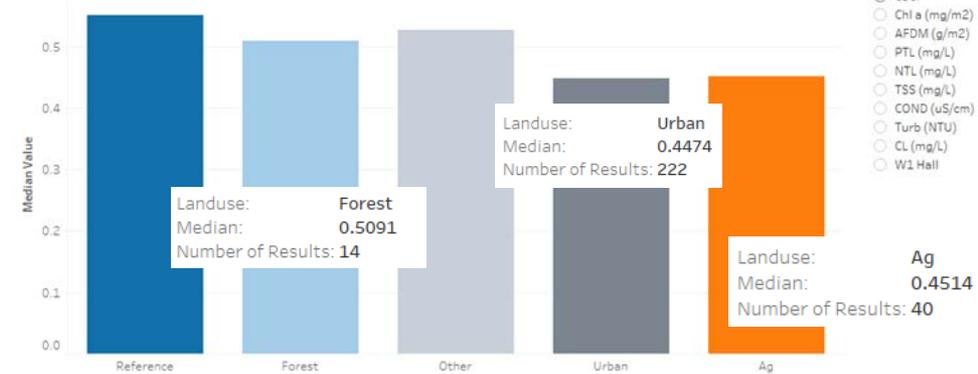
# Where are the Altered Biological Streams?

Landuse and CSCI Condition



	Number of Results	Minimum	Median	Average	Maximum
CSCI	389	0.11	0.48	0.46	0.62
Chl a (mg/m2)	288	0.00	22.99	46.08	450.78
AFDM (g/m2)	269	0.00	19.70	53.67	840.08
PTL (mg/L)	289	0.00	0.11	0.72	140.00
NTL (mg/L)	281	0.00	0.92	3.43	136.65
TSS (mg/L)	267	0.00	6.00	19.81	700.00
COND (uS/cm)	329	0.00	831.00	1,294.32	31,650.00
Turb (NTU)	255	0.08	2.83	9.62	320.00
CL (mg/L)	285	0.14	42.70	152.68	9,730.00
W1 Hall	322	0.00	2.16	2.38	10.50

Landuse

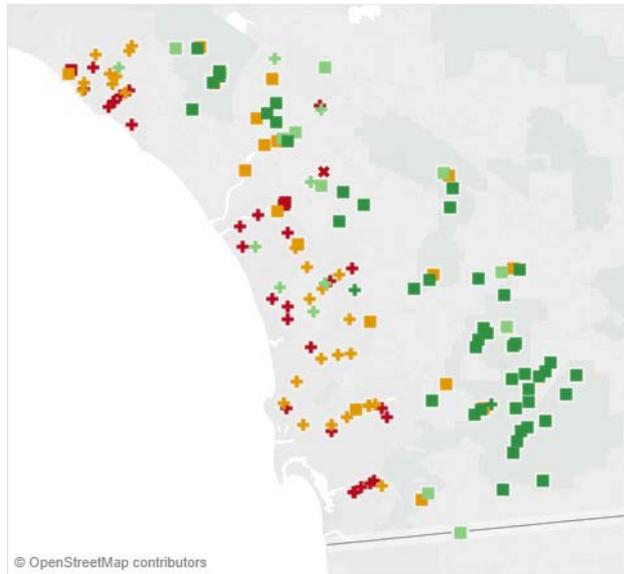


# What is the biological condition in the San Diego region?

select Regional Board



Landuse and CSCI Condition



**CSCI Condition**

- Likely Intact
- Possibly Altered
- Likely Altered
- Very Likely Altered

**Landuse**

- Other
- Urban
- Ag

**Reference/Probabilistic**

(All)

Probabilistic

Reference

**Landuse**

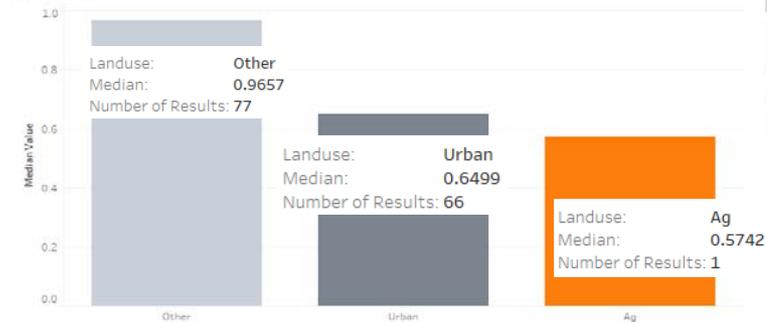
(All)

**CSCI Condition**

(All)

	Number of Results	Minimum	Median	Average	Maximum
CSCI	144	0.38	0.78	0.81	1.27
Chl a (mg/m2)	137	0.00	28.40	41.16	227.06
AFDM (g/m2)	103	1.59	25.40	49.86	350.80
PTL (mg/L)	120	0.00	0.06	0.12	4.50
NTL (mg/L)	107	0.00	0.75	2.29	16.00
TSS (mg/L)	121	0.00	4.00	9.59	183.00
COND (uS/cm)	140	97.70	1,471.50	1,765.56	10,739.00
Turb (NTU)	116	0.00	1.93	4.87	85.20
CL (mg/L)	123	13.18	169.00	266.52	1,900.00
W1 Hall	143	0.00	0.67	1.23	5.54

Landuse

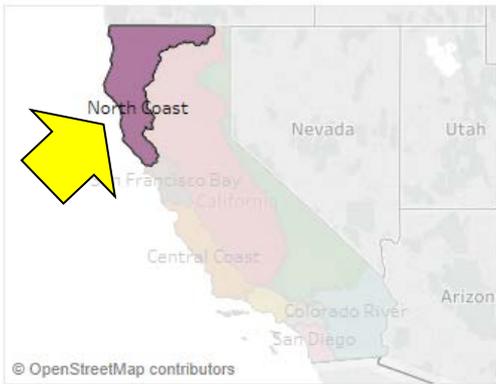


- Parameter**
- CSCI
  - Chl a (mg/m2)
  - AFDM (g/m2)
  - PTL (mg/L)
  - NTL (mg/L)
  - TSS (mg/L)
  - COND (uS/cm)
  - Turb (NTU)
  - CL (mg/L)
  - W1 Hall

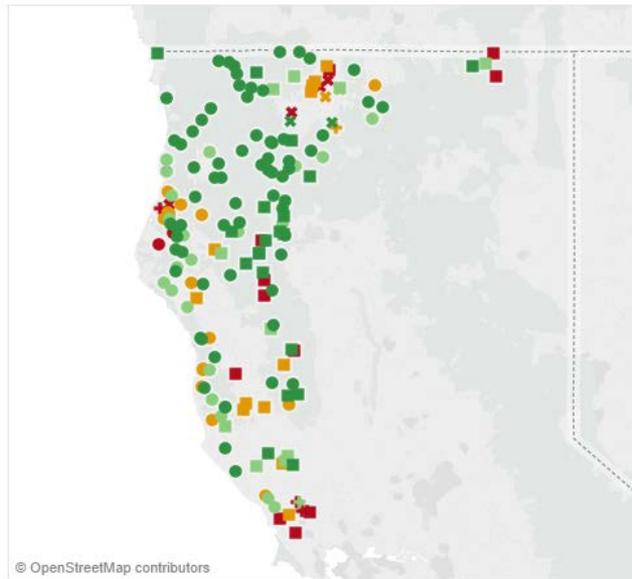
Surface Water Ambient Monitoring Program

# What is the biological condition in the North Coast region?

select Regional Board



Landuse and CSCI Condition



**CSCI Condition**

- Likely Intact
- Possibly Altered
- Likely Altered
- Very Likely Altered

**Landuse**

- Forest
- Other
- + Urban
- × Ag

**Reference/Probabilistic**

(All)

Probabilistic

Reference

**Landuse**

(All)

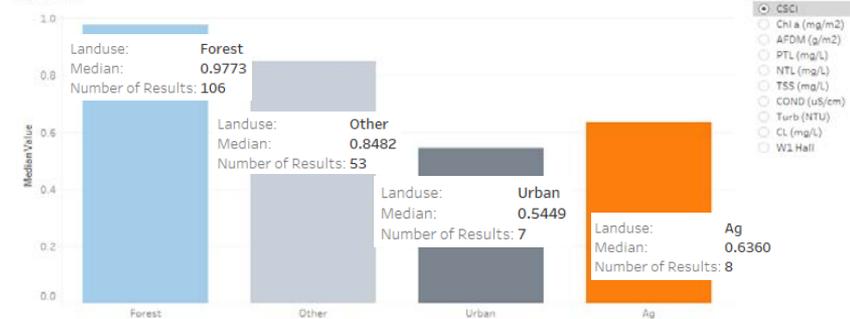
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**CSCI Condition**

(All)

	Number of Results	Minimum	Median	Average	Maximum
CSCI	174	0.24	0.92	0.90	1.33
Chl a (mg/m2)	170	0.00	8.56	13.87	97.73
AFDM (g/m2)	159	0.00	6.20	9.57	59.80
PTL (mg/L)	173	0.00	0.02	0.03	0.79
NTL (mg/L)	173	0.00	0.11	0.22	2.52
TSS (mg/L)	161	-0.30	0.90	3.06	34.30
COND (uS/cm)	174	23.68	185.90	229.90	2,480.00
Turb (NTU)	172	0.01	0.44	1.29	12.30
CL (mg/L)	173	0.00	3.75	6.47	77.90
W1 Hall	174	0.00	0.33	0.60	4.72

Landuse



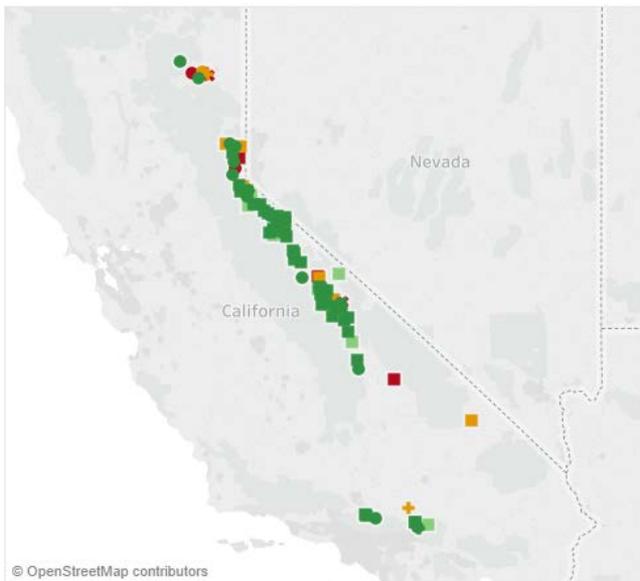
Surface Water Ambient Monitoring Program

# What is the biological condition in the Lahontan region?

select Regional Board



Landuse and CSCI Condition



**CSCI Condition**

- Likely Intact
- Possibly Altered
- Likely Altered
- Very Likely Altered

**Landuse**

- Forest
- Other
- + Urban
- x Ag

**Reference/Probabilistic**

(All)

Probabilistic

Reference

**Landuse**

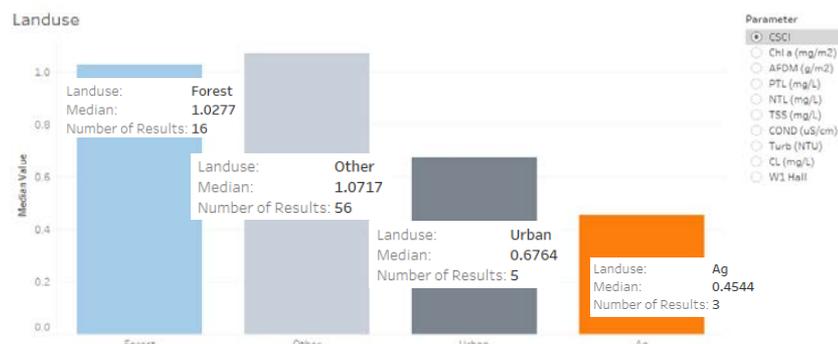
(All)

< >

**CSCI Condition**

(All)

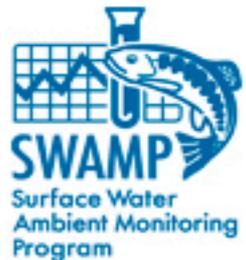
	Number of Results	Minimum	Median	Average	Maximum
CSCI	80	0.36	1.03	0.96	1.28
Chl a (mg/m2)	76	0.00	5.87	11.35	83.20
AFDM (g/m2)	71	0.00	6.56	10.07	50.96
PTL (mg/L)	76	0.00	0.02	0.03	0.32
NTL (mg/L)	76	0.00	0.10	0.17	1.07
TSS (mg/L)	66	0.00	2.20	4.30	29.20
COND (uS/cm)	80	0.00	70.60	168.19	4,234.00
Turb (NTU)	76	0.12	1.08	1.64	10.55
CL (mg/L)	76	0.00	0.51	8.94	439.00
W1 Hall	80	0.00	0.33	0.69	4.31



Surface Water Ambient Monitoring Program

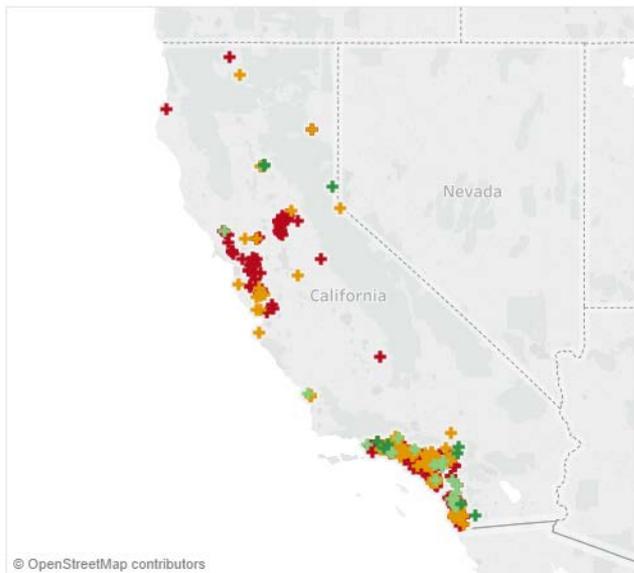
# Instant Feedback

- Dashboard can map/graph/summarize different datasets.
  - Filter for only intact/altered biology
  - Filter for regional board specific data
  - Bar graph display results by landuse



# What is the biological condition of streams that drain urban landuses?

Landuse and CSCI Condition



- CSCI Condition
- Likely Intact
  - Possibly Altered
  - Likely Altered
  - Very Likely Altered
- Landuse
- + Urban

Reference/Probabilistic

- (All)
- Probabilistic
- Reference

Landuse

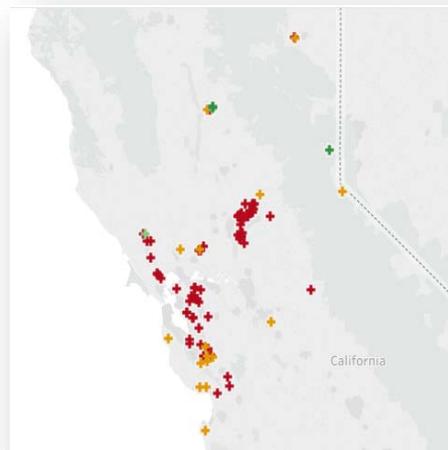
Urban

CSCI Condition

(All)



Northern California



Southern California



© OpenStreetMap contributors

	Number of Results	Minimum	Median	Average	Maximum
CSCI	361	0.11	0.56	0.56	1.12
Chl a (mg/m2)	279	0.00	31.72	52.81	450.78
AFDM (g/m2)	247	0.07	28.57	69.78	840.08
PTL (mg/L)	263	0.00	0.13	10.78	1,500.00
NTL (mg/L)	268	0.00	1.30	2.80	28.00
TSS (mg/L)	265	0.00	6.40	17.99	428.70
COND (uS/cm)	322	2.80	1,143.50	1,449.01	10,739.00
Turb (NTU)	228	0.00	2.75	8.10	320.00
CL (mg/L)	269	0.37	128.00	179.04	1,900.00
W1 Hall	325	0.00	2.53	2.68	10.50

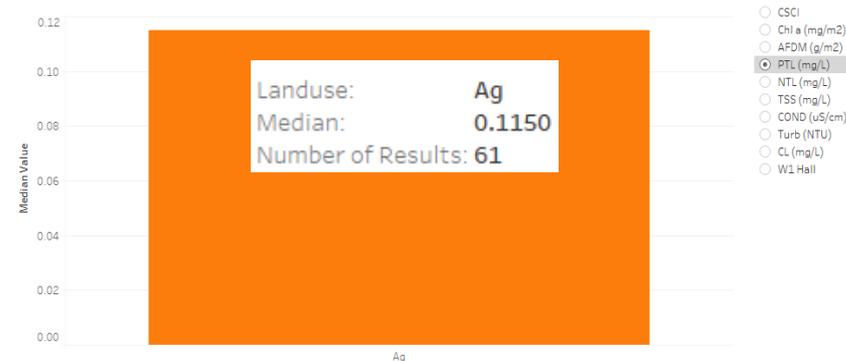


# What is the biological condition of streams that drain agricultural landuses?

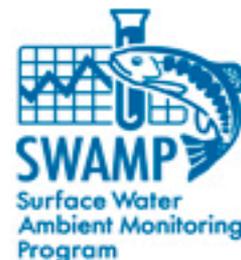
Landuse and CSCI Condition



Landuse

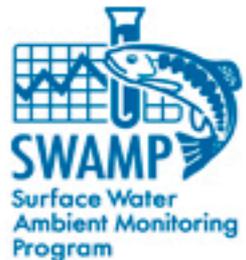


	Number of Results	Minimum	Median	Average	Maximum
CSCI	64	0.22	0.57	0.56	1.10
Chl a (mg/m2)	58	0.00	12.45	45.73	454.55
AFDM (g/m2)	55	2.99	13.92	29.27	278.45
PTL (mg/L)	61	0.00	0.12	0.35	2.85
NTL (mg/L)	56	0.01	0.84	5.30	89.75
TSS (mg/L)	51	0.50	10.00	42.87	700.00
COND (uS/cm)	62	22.30	285.00	713.73	4,105.00
Turb (NTU)	53	0.18	3.58	25.24	680.00
CL (mg/L)	59	0.38	5.50	41.74	206.34
W1 Hall	62	0.00	1.61	1.96	5.73



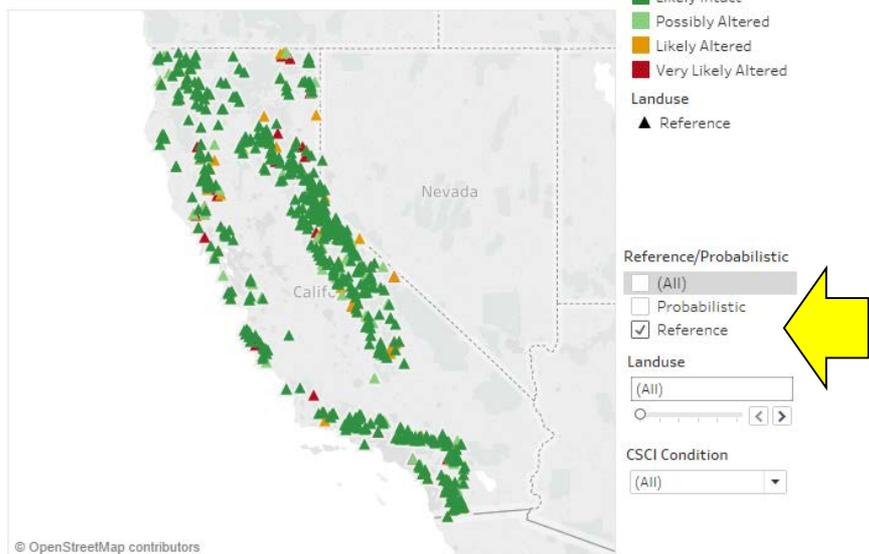
# Report on Landuses

- Urban and Agricultural Landuses
  - Most streams in these landuses have altered biology based on median CSCI score
  - Most urban streams have high results for chlorophyll a
    - One symptom of degraded water quality condition is the increase of algae biomass as measured by chlorophyll a
  - High W1\_HALL results
    - Riparian human disturbance index used to interpret physical habitat field data

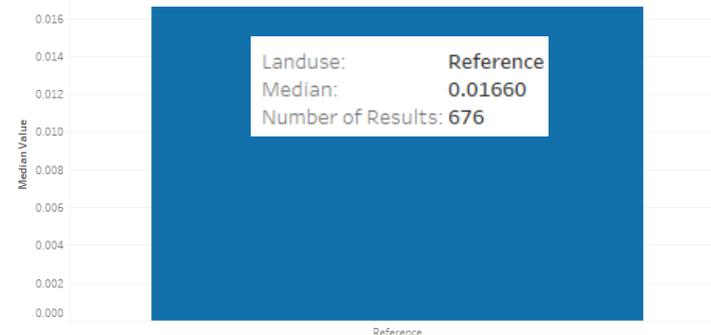


# Where are the reference streams?

Landuse and CSCI Condition



Landuse

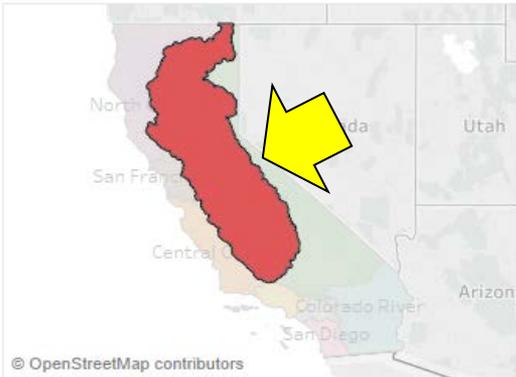


	Number of Results	Minimum	Median	Average	Maximum
CSCI	1,527	0.29	1.01	1.00	1.40
Chl a (mg/m2)	674	0.01	6.94	13.02	372.11
AFDM (g/m2)	543	1.01	6.19	12.67	478.00
PTL (mg/L)	676	0.00	0.02	0.02	0.57
NTL (mg/L)	501	0.01	0.10	0.16	3.72
TSS (mg/L)	402	0.10	1.20	3.17	310.00
COND (uS/cm)	748	0.00	133.75	233.01	2,667.00
Turb (NTU)	620	0.00	0.69	1.31	30.80
CL (mg/L)	560	0.11	1.42	8.49	193.00
W1 Hall	405	0.00	0.00	0.23	2.73

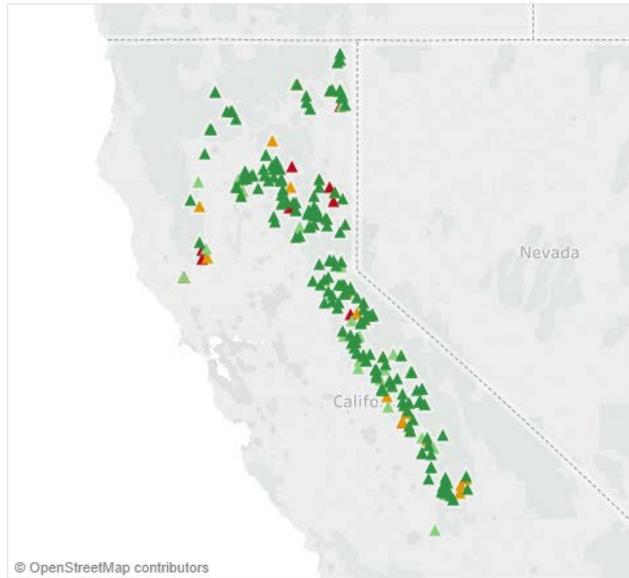


# What are reference conditions for streams in Region 5?

select Regional Board



Landuse and CSCI Condition



- CSCI Condition
- Likely Intact
  - Possibly Altered
  - Likely Altered
  - Very Likely Altered
- Landuse
- ▲ Reference

- Reference/Probabilistic
- (All)
  - Probabilistic
  - Reference
- Landuse
- (All)
- CSCI Condition
- (All)

	Number of Results	Minimum	Median	Average	Maximum
CSCI	402.0	0.29	1.02	1.00	1.35
Chl a (mg/m2)	175.0	0.32	7.72	14.37	123.00
AFDM (g/m2)	164.0	1.30	5.04	11.17	478.00
PTL (mg/L)	185.0	0.00	0.02	0.03	0.20
NTL (mg/L)	132.0	0.01	0.08	0.13	3.48
TSS (mg/L)	127.0	0.10	1.00	1.54	17.00
COND (uS/cm)	181.0	0.00	78.00	110.72	776.00
Turb (NTU)	151.0	0.00	0.66	1.01	9.34
CL (mg/L)	175.0	0.11	0.59	2.44	58.80
W1 Hall	123.0	0.00	0.05	0.24	1.80

Landuse

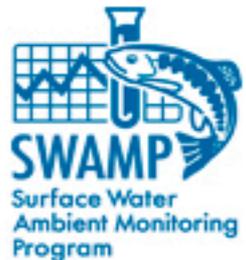
Median Value

Landuse: Reference  
 Median: 0.02060  
 Number of Results: 185

- Parameter
- CSCI
  - Chl a (mg/m2)
  - AFDM (g/m2)
  - PTL (mg/L)
  - NTL (mg/L)
  - TSS (mg/L)
  - COND (uS/cm)
  - Turb (NTU)
  - CL (mg/L)
  - W1 Hall

# Summary

- Dashboards can help management make data-driven decisions
  - Maps, graphs, and summary tables instead of spreadsheets
- Users interact with the data using maps, sliders, checkboxes through a website
- This dashboard can help communicate monitoring results at regional and state level
  - Urban and Agricultural landuses tend to have degraded biology as measured by the CSCI



# Thank You

URL: <https://public.tableau.com/en-us/s/>  
Search: Communicate Bioassessment

**Calvin Yang**

916-341-5545

[calvin.yang@waterboards.ca.gov](mailto:calvin.yang@waterboards.ca.gov)

Learn More:

[https://www.waterboards.ca.gov/water\\_issues/programs/swamp/bioassessment/](https://www.waterboards.ca.gov/water_issues/programs/swamp/bioassessment/)

