



2011 Wadeable Stream Aquatic Community Resource Brief

Lassen Volcanic National Park



Why monitor streams?

Water quality and aquatic communities were identified as high-priority vital signs. Streams are a dominant feature of the landscape, both aesthetically and functionally in the parks. Their position in the watershed, integrating upstream watershed disturbances, both naturally occurring and man-made, makes them powerful vital signs for monitoring park conditions. See the full, [final protocol](#) for additional details.

Aquatic Community parameters of concern

This resource brief focuses on four biological indices that are monitored by the Klamath Inventory and Monitoring Network. They are: (1) EPA Invertebrate Multi-Metric Index (MMI), (2) EPA Aquatic Vertebrate MMI, (3) Observed/Expected ratio of taxa loss, and (4) regional MMI indices (in this case, eastern Sierra Nevada IBI [[Herbst and Silldorff 2009](#)]). The first three indices comprise the indicators of biological condition used by the Environmental Protection Agency's [Wadeable Streams Assessment](#), and the final one uses the California Regional Water Quality Control Board index. All four of these indices take complex ecological information collected from our field sampling of 100+ invertebrate and vertebrate species and distill it down to a single variable for natural resource condition assessments.



Why invertebrates? Stream invertebrates are a diverse group of organisms encompassing many life history traits, food sources, habitat requirements, reproduce quickly and with limited dispersal, and act as a vital pathway for energy flow from stream primary producers to top vertebrate consumers in aquatic environments (fish, amphibians) and terrestrial environments (birds, bats, spiders). These traits, along with varied but predictable responses to anthropogenic disturbance make them ideal biomonitoring organisms. We also use a single vertebrate index, but a natural low diversity in mountain streams reduces the utility of fish and amphibians as sole indicators of aquatic health.

What are multi-metrics indices? Originally used in Midwestern streams with fish assemblages, these indices combine information from multiple aspects of community data: composition, diversity, feeding specializations, habits, tolerance to pollution, and overall richness of the stream. By combining these individual metrics, an overall comprehensive robust index of ecological health, much the same way the Dow Jones Industrial index combines many individual metrics into a single, trackable number reflecting economic health. Each metric is independently developed using larger regional datasets calibrated to different disturbances. Hence, different MMIs may score and inform managers differently.



What are O/E scores? The Observed/Expected Ratio of Taxa Loss is a measure of ecological health using the number of macroinvertebrate taxa not present at a site based on expected conditions using regional, non-impacted reference sites. Using a large sample set of these reference sites, a predicted/expected value of taxa under no impairment can be modeled. The number actually observed is then compared using a ratio of the Observed/Expected. Values range from 0 (no expected taxa present) to just over 1 (more taxa present than expected). Interpretation is based on each tenth of a point less than 1 equating to a 10% loss of taxa at a site. Hence, a score of 0.80 equals a 20% loss in expected biodiversity.

Results

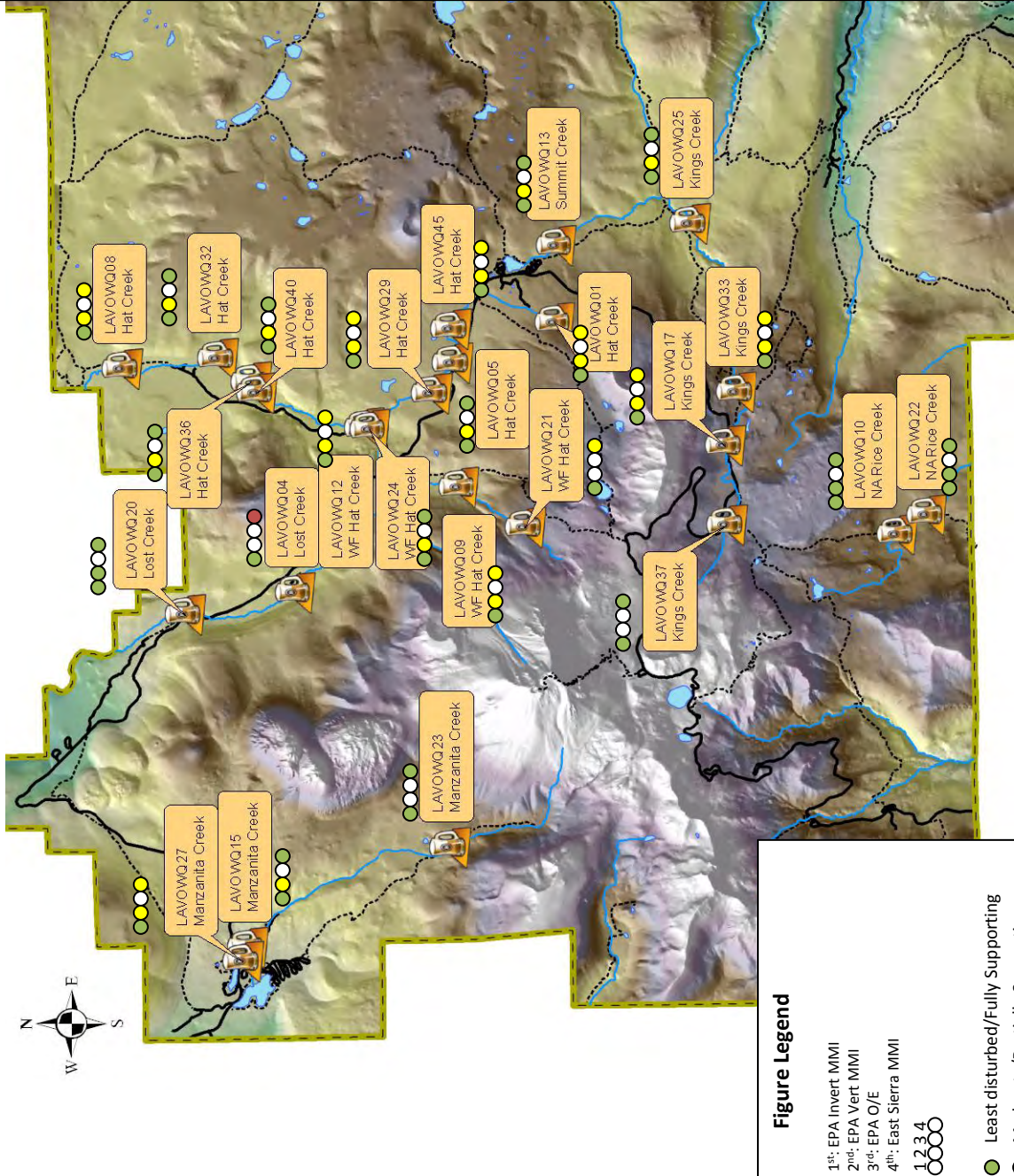
Twenty-four sites were sampled in the summer of 2011, the first field season for Lassen Volcanic NP wadeable stream (see map/results on back). Future years (2014, 2017, etc.) will resample these same sites (plus additional ones if time/funding allows) for current status and eventual trend detection.

In general, biological indicators suggest above average to excellent water quality compared to national sites. The EPA MMIs give mixed results, with invertebrates showing excellent water quality, but vertebrate MMI showing more mixed results – largely due to the presence of alien trout species and naturally low diversity streams. The Eastern Sierra MMI, the closest regional MMI for Lassen Volcanic NP, shows mixed results, with one degraded site (Lost Creek), however individual indices suggest a healthy invertebrate population, albeit with lower mayfly and aquatic mites compared to Eastern Sierra streams. Overall interpretation of these results must be in the context of the original metric and how the metric was created, and for final interpretation, please consult the forthcoming annual report.

	EPA West-Wide Invertebrate MMI	EPA West-Wide Vertebrate MMI	EPA West-Wide O/E ²	Eastern Sierra Invert. MMI	
Sample size	24	20 ¹	N/A	24	
Average (SE)	85 (±1.1)	48 (±2.4)	N/A	82 (±1.4)	
Median	84.5	42.6	N/A	82	
Range	75 - 95	42 - 71	N/A	63 - 93	
# Least Disturbed	24	3	N/A	13	# Supporting
# Moderate	0	17	N/A	10	# Partially Supporting
# Most Disturbed	0	0	N/A	1	# Not Supporting

¹Four streams did not have any vertebrates ²Awaiting necessary files from EPA for these calculations

Lassen Volcanic NP Wadeable Streams Sampling Sites



Note: There were no sampled sites in the far east of the park (dry or intermittent sites) and no sites in the southwest of the park (too steep and dangerous to sample).

Actual Values

Stream name	Site Code	Metric			
		EPA Invert MMI	EPA Vert MMI	O/E	East Sierra MMI
Hat Creek	LAVOWQ01	84	42.6		77
Lost Creek	LAVOWQ04	81			63
Hat Creek	LAVOWQ05	89	42.6		84
Hat Creek	LAVOWQ08	87	42.6		75
WF Hat Creek	LAVOWQ09	85	42.6		78
NA Rice Creek	LAVOWQ10	95	71		83
WF Hat Creek	LAVOWQ12	87	42.6		80
Summit Creek	LAVOWQ13	79	42.6		93
Manzanita Creek	LAVOWQ15	75	60.35		85
Kings Creek	LAVOWQ17	89	42.6		80
Lost Creek	LAVOWQ20	81	71		89
WF Hat Creek	LAVOWQ21	84			70
NA Rice Creek	LAVOWQ22	90	71		89
Manzanita Creek	LAVOWQ23	80			86
WF Hat Creek	LAVOWQ24	80	42.6		84
Kings Creek	LAVOWQ25	83	50.12		91
Manzanita Creek	LAVOWQ27	83	52.86		79
Hat Creek	LAVOWQ29	89	42.6		80
Hat Creek	LAVOWQ32	79	42.6		84
Kings Creek	LAVOWQ33	95	42.6		75
Hat Creek	LAVOWQ36	90	42.6		86
Kings Creek	LAVOWQ37	83			88
Hat Creek	LAVOWQ40	86	42.6		82
Hat Creek	LAVOWQ45	91	42.6		79

All metrics range from 0 – 100. However, condition is assigned on different threshold values based on reference, non impacted sites.

Condition Thresholds*

EPA				East Sierra	
Invert. MMI	Vert. MMI	O/E		MMI	MMI
Least Disturbed	≥ 71	≥ 62	≥ 80		>80.4
Most Disturbed	<57	<37	<50		<63.2

*Sources: [Stoddard et al. 2005](#), [EPA 2006](#)