AMERICAN RIVER CONSERVANCY

Preserving Rivers and Land for Life

BERKELEY LAB

UCDAVIS

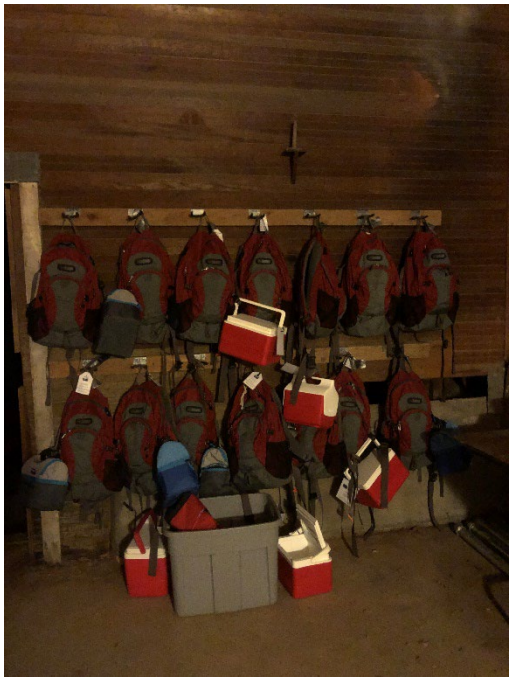
CIVIL AND ENVIRONMENTAL ENGINEERING

January 28, 2023

Subject: New storms and recap from 2022

Dear ARC team members and water quality monitoring volunteers,

What an eventful year for our Watershed Quality Monitoring partnership! Thank you for all your hard work this year. Because of your dedication we have collected 241 water samples across the watershed to date, all in the face of crazy winter storms, fire and smoke concerns, and everything else that the past couple years have thrown at us. That's amazing! We would like to take a moment to reflect on 2022, share some current results, and give some updates on where we're headed, but first, check out these great photos from this past year.

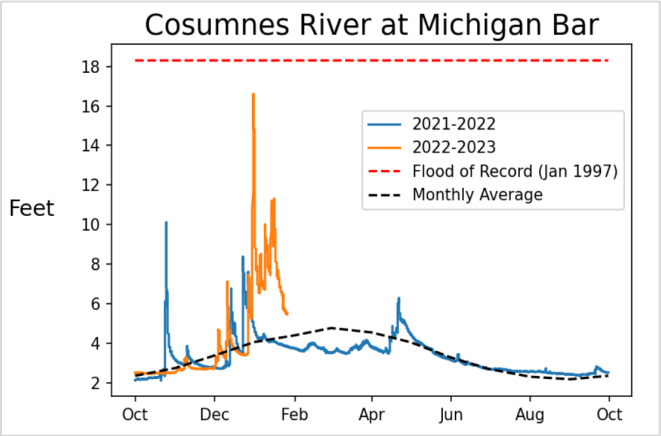


Backpacks, coolers and field equipment for all our monitoring sites at Wakamatsu.

From top-to-bottom: high burn severity forest at Capps crossing (left) on October 15, 2020; headwater snowpack on January 21, 2023 hiding the river (right); logging along MET (left); Dr. Jinwoo Im (postdoctoral fellow at LBNL collecting samples at Foster Meadows on Jan 21, 2023 (right); Peter Spalholz (MS student, UC Davis) at Gauging Station on Camp Creek (left); Dr. Michelle Newcomer and Dr. Jackie Peña collecting soil samples at Capps Crossing, October 2022 (right).

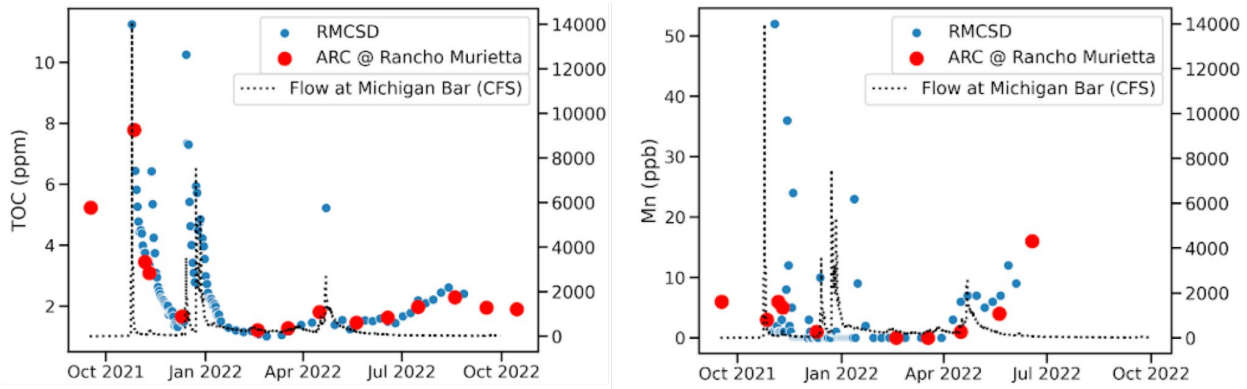
Recent Storms

We thought the atmospheric river in October 2021 was a lot of water (it was!), but the flows from the recent storms are dwarfing that event. The peak flow of 65,143 cubic feet per second and a flood stage of 16.6 feet at 3pm on New Year's Eve was almost 5 times last year's maximum flow! This is still less than the highest flood recorded since 1907 (it happened on January 2, 1997; the flood gauge stopped working and the flood stage was recorded at 18.3 feet).



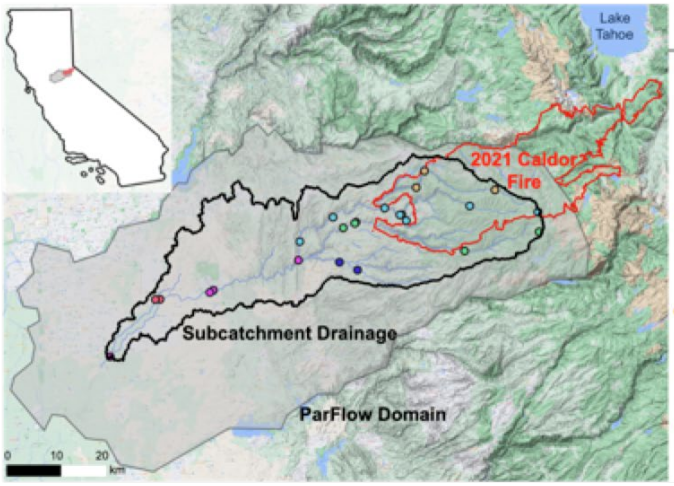
No matter how you cut it, the watershed has received an enormous amount of water this season, which brings both relief and potential hazards to the water-stressed area. Flooding and erosion risks have certainly been elevated these last few weeks, and we hope everyone out there has stayed safe and avoided most of the damage. The sustained high flows also present us with a lot of questions about how the watershed is responding.

We are excited to dive into the data analysis. We will be looking to see where the water chemistry might be similar or different, which we hope will give us more clues as to how the fire has impacted the river. Will concentrations show similar peaks in response to higher flows as they did last year? Will the more severe burn areas behave differently than the lower ones? Which elements will show the most change? These are the kind of questions we hope to answer. In the results below from Rancho Murietta, notice how total organic carbon and manganese respond differently to flow, and how concentrations increase over the course of the summer. How will the data from this year compare?



Total organic carbon (TOC) and manganese (Mn) concentrations collected by ARC volunteers at Rancho Murietta site (red dots) shown together with data collected weekly by the Rancho Murieta Community Services District (blue dots).

With the help of ARC volunteers, we are also able to interpret the impacts of the fire across the watershed *across different elevation and burn gradients* (see table below, sample site colors correspond to the different tributaries). Luckily, the way the fire burned relative to the sample sites allows us to observe the water chemistry without the presence of any burn scars (e.g. at Foster Meadows, PiPi and the South Fork sites). We are then analyzing how sub-catchments with *high burn area* and/or *high burn severity* (e.g. Camp Creek sites) compare.



Tributary	Subwatershed Name	Sample Point Elevation (m)	Drainage Area (km²)	% Area Burned	% Severe Burned
North Fork	Leek Springs	2,220	0.4	100%	14%
	Capps Crossing	1,526	51.2	99%	51%
	Steely Fork	861	54.5	94%	76%
	Above Diversion	741	180.0	91%	69%
	Below Diversion	726	180.7	91%	69%
	Sweeney Bridge	617	191.1	86%	65%
	Ladies Valley	362	438.8	72%	49%
	Sand Ridge	256	529.8	58%	40%
Middle Fork	Foster Meadows	2,081	1.5	0%	0%
	Pi Pi	1,200	105.7	3%	1%
	E-16 Bridge	507	248.0	39%	23%
	Mt. Aukum Bridge	503	277.7	35%	21%
	Outingdale	485	283.4	34%	20%
Camp Creek	Pilliken	1,673	19.0	100%	65%
	Sly Park	1,103	76.3	100%	75%
	Gauging Station	946	85.9	100%	71%
South Fork	Beals harmony Hill	642	47.9	0%	0%
	River Pines	562	154.2	0%	0%
Below Confluence	N/M Fork Confluence	240	1,070.5	38%	25%
	Above Granlee	51	1,390.6	29%	19%
	Rancho Murieta	39	1,400.4	29%	19%
	Mahon Ranch	18	1,864.8	22%	33%

Map of ARC sample sites relative to the watershed drainage basin, the Caldor fire, and our modeling domain (more to come on this later!). Sites are color-coded by tributary (see table), sorted by elevation, and showing percentage of corresponding burn area.

Recap from 2022

While recent events have certainly stolen our attention, we also want to highlight the accomplishments from 2022. In October, we had a wonderful Volunteer Appreciation Event at Wakamatsu Farm! We enjoyed sharing our results with you all, and we benefited greatly from the insights you shared with us- not to mention the delicious potluck that everyone brought, and the meal that ARC provided for all of us! We would also like to congratulate Dr. James Dennedy-Frank, a postdoctoral researcher on our team (**shown working hard collecting soil samples on the right**) who accepted a faculty position at Northeastern University this past year. We will certainly miss his invaluable contributions but are excited for him nonetheless. Jade Hinson, our GIS whiz, wrapped up her internship with the team and has started her Masters in Civil and Environmental Engineering at UC Davis.

Volunteer Appreciation Event, Wakamatsu Farm, October 15, 2022.

We also had the opportunity to present our work, and the data you helped to collect, at several confereces. **Shown on the right,** Dr. Michelle Newcomer presented at the American Geophysical Union Conference in Chicago, December, 2022. Dr. Erica Woodburn also gave a briefing to the California Legislative Staff, Assembly Water, Parks and Wildlife Committee, and Senate Natural Resource Committee on wildfire impacts to water and Dr. Jackie Pena presented at the UC Davis Environmental Health Sciences Annual Meeting.

The feedback is always clear – there is broad interest and necessity for this work and the dataset we're creating!

Where are we headed?

As we reflect on the past year, it is also important to keep the future in mind. We are working to raise funds to allow us to continue this project to develop a greater understanding of the link between wildfire and stream water chemistry, not only immediately after fire but also in subsequent years. We think this work can go even further and inform us about the ways in which climate change can influence the water chemistry of an entire watershed. To reach these goals, we've submitted proposals for funding from NASA and the UC Davis Institute of the Environment, applied for a fellowship from the National Science Foundation, and put in bids for "beamtime" at the particle accelerator at Lawrence Berkeley National Laboratory and Stanford Synchrotron Radiation Lightsource.

Have any questions or suggestions? Please contact us at pena@ucdavis.edu