

Data Quality Needs for a Smoke Sensor Network



*Monterey Bay Air
Resources District*

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EPA 2023 Air Sensors
Quality Assurance
Workshop

Data Quality Requirements

- Regulatory Air Monitoring Network
 - Designed to Measure for National Ambient Air Quality Standards
 - Need accurate and precise data
 - Insufficient for communicating community level smoke impact
- Rank of data quality requirements by application
 - Regulatory monitoring
 - Monitoring in disadvantaged and Low-Income Communities (AB617)
 - Measuring smoke impacts – Wildfires and Prescribed Burns
 - Seasonal Monitoring in Smoke Sensitive Areas
 - Air quality forecasts (observe trends)

Sobranes Fire

July - October 2016



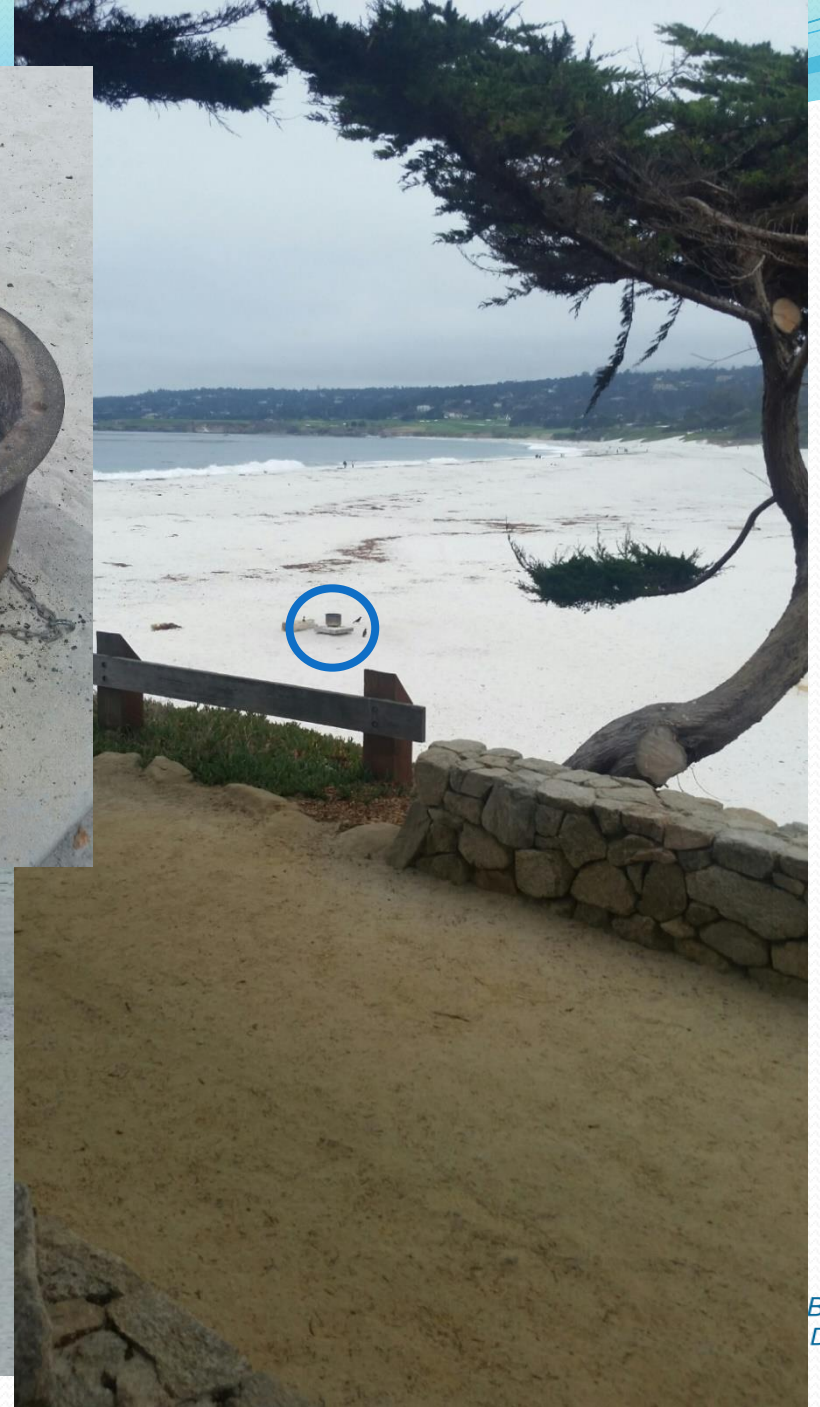
Regulatory Air Monitoring Network



Explaining Smoke Impacts to the Community

- Lots of confusion about regulatory monitoring
 - Not “real time”
 - Reports late – up to 3 hours at times
 - On PST not PDT – immediately appears to be one hour late
 - 24-hour average – Midnight to Midnight
 - History of impact, not what they are immediately experiencing
 - Reports “GOOD” when obviously lots of smoke in the air
 - Reports “Hazardous” when apparently the sky is clear
 - Residents want to know where to go to escape the smoke
- Goal – To help the community understand the severity of the smoke impact

Carmel Beach Fires - Sensor Project





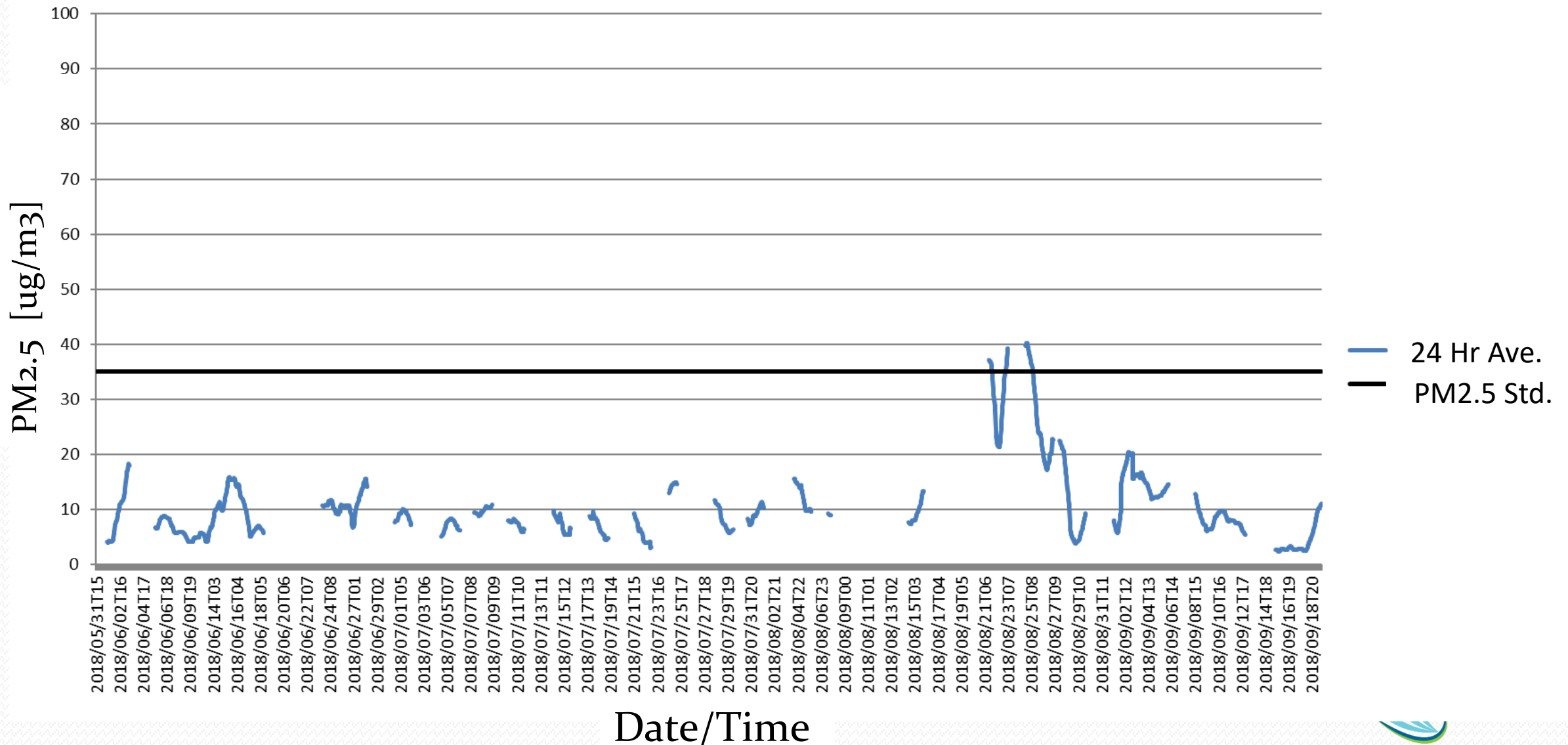


Carmel Beach - 11th Ave. Sensor

Carmel Beach Sensor Locations



Carmel Valley - 11th Avenue Sensor



Wildfire Smoke Sensor Network - Concerns

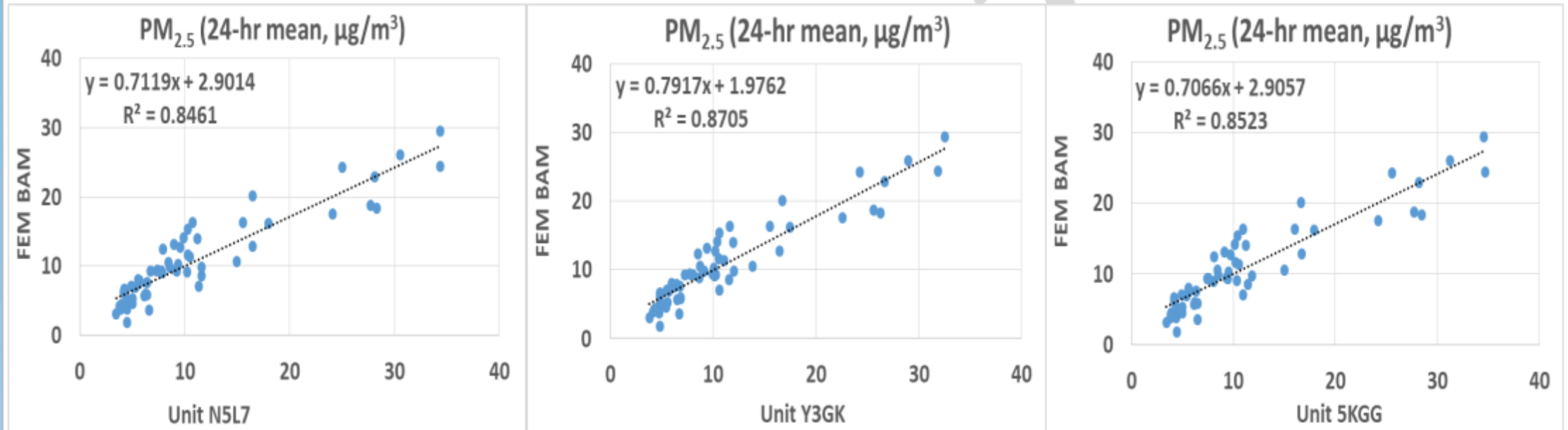
- “Inexpensive Option” – ends up costing more due to the time involved setting up and maintaining.
- Requires line power and access to Wi-Fi
 - Difficult to adapt to remote locations
- Published map is misleading on AQI – defaults to 10-minute averages – confuses public
- Already a lot sensors out there – don’t know how they’re installed; influenced by a nearby source

Choose Best Sensor to Fit Requirements

- Self contained
- 4G service
- Solar/battery-powered
- Easy to install
- No maintenance/calibrations
- Can publish data on own platform

- Clarity seemed to fit these requirements

South Coast AQ-SPEC Field Results for Clarity 2/15/2018 to 04/25/2018



- Clarity Node PM_{2.5} mass measurements correlate well with the corresponding FEM BAM data ($R^2 > 0.84$)

Evaluation of Clarity Sensor

Collocation at San Lorenzo Valley
Site 9/28/2020 – 1/12/2021

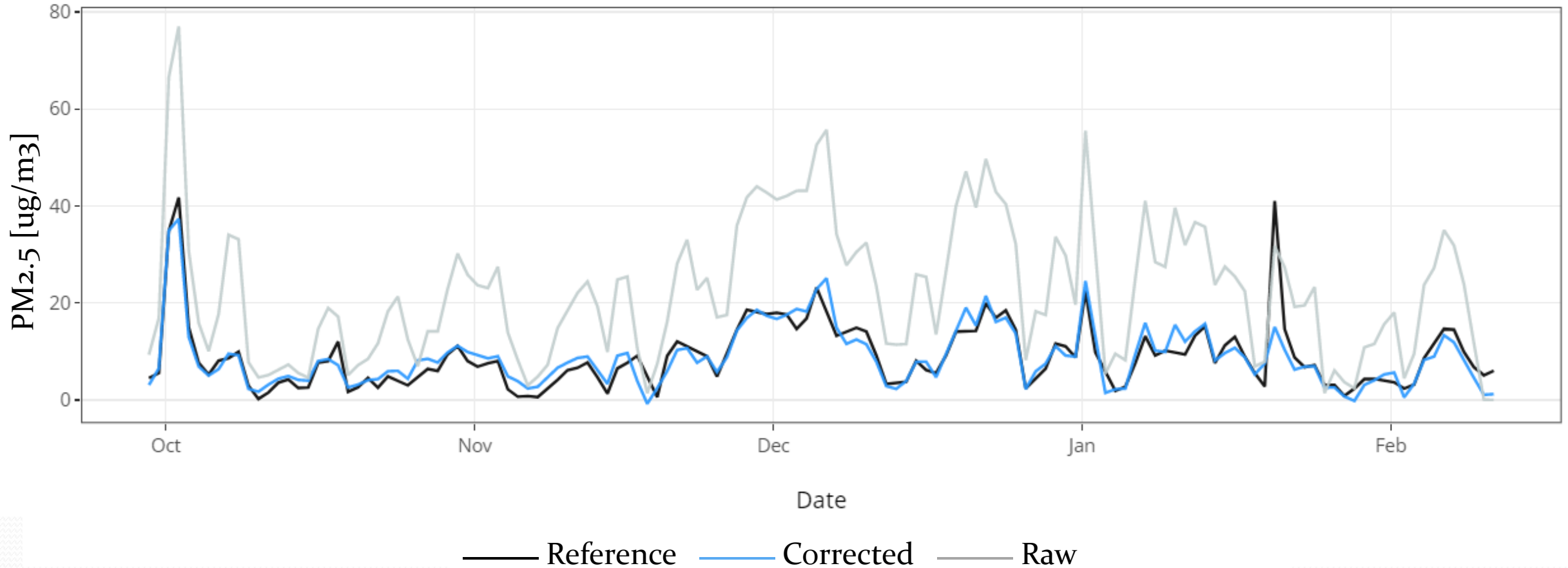
- Area known for elevated concentration of smoke from woodburning stoves and fireplaces
- Compared to BAM 1020 for 3 months
 - Data Tracked well; $R^2 = 0.80$
- Applied Correction Factor

Clarity Sensor



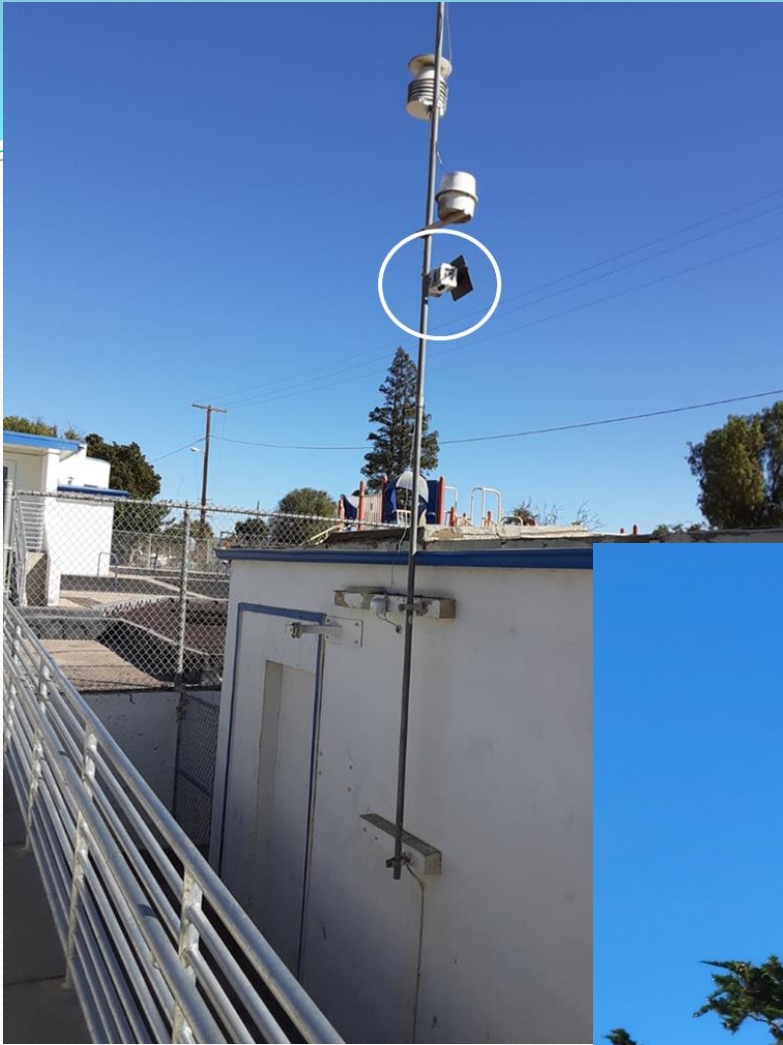
Collocated data with Correction

San Lorenzo Valley Air Monitoring Station

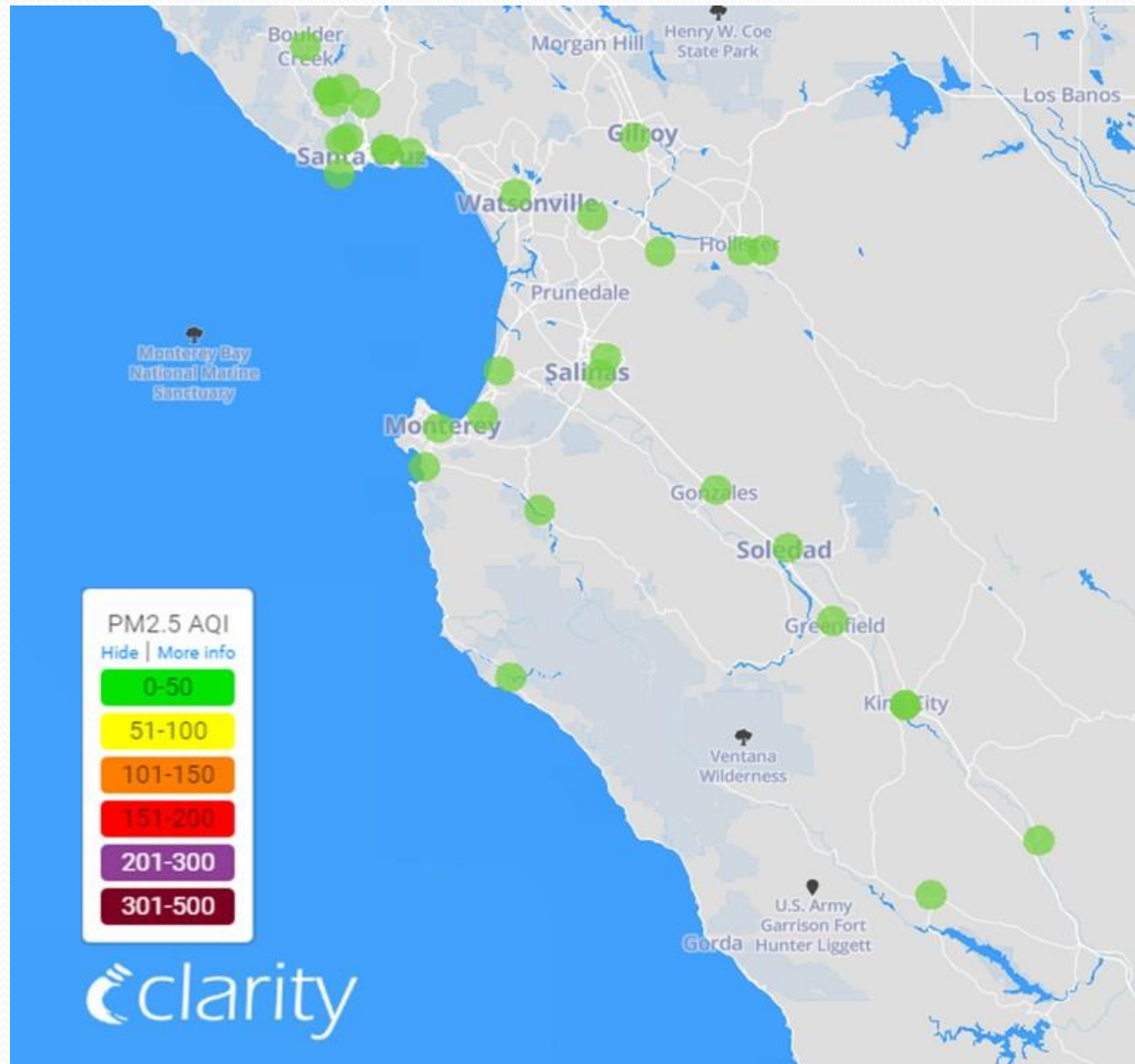


Installation Plan

- Increase density and distribution of sensors throughout region
- One per municipality – 18 throughout 3 counties
- One per unincorporated population center
- Total of 30 sensors



Air Sensor Network on Open Map

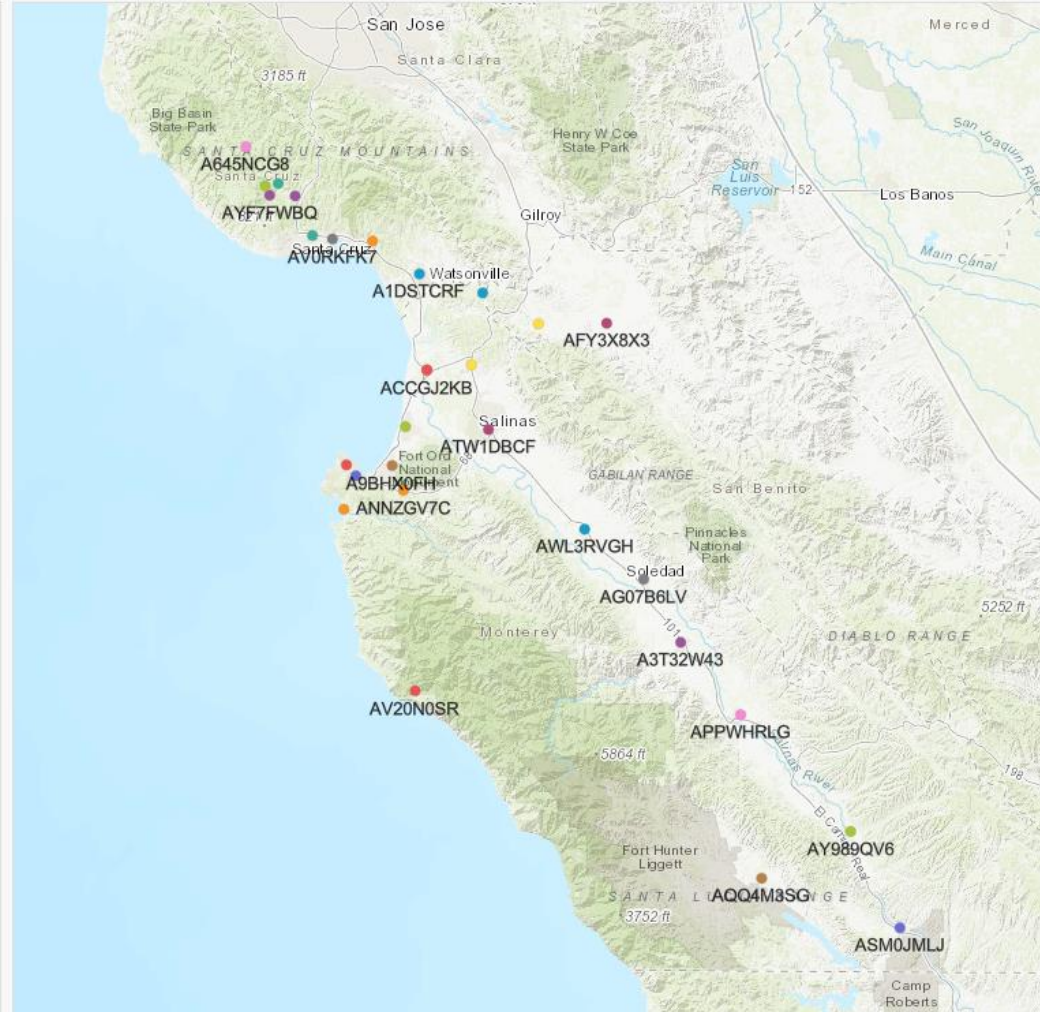


Local Sensor Network Map

Sensor ID	Nowcast	Averaging Period
AYW1PRKD	25.0	3
AYW1PRKD	25.0	12
AYF7FWBQ	42.0	3
AYF7FWBQ	40.0	12
AY989QV6	71.0	3
AY989QV6	75.0	12
AWL3RVGH	31.0	3
AWL3RVGH	32.0	12
AV20N0SR	22.0	3
AV20N0SR	34.0	12
AV0RKFK7	26.0	3
AV0RKFK7	25.0	12
ATW1DBCF	29.0	3
ATW1DBCF	29.0	12
ASM0JMLJ	51.0	3
ASM0JMLJ	51.0	12
AS4L7TDD	37.0	3
AS4L7TDD	36.0	12
AQQ4M3SG	39.0	3

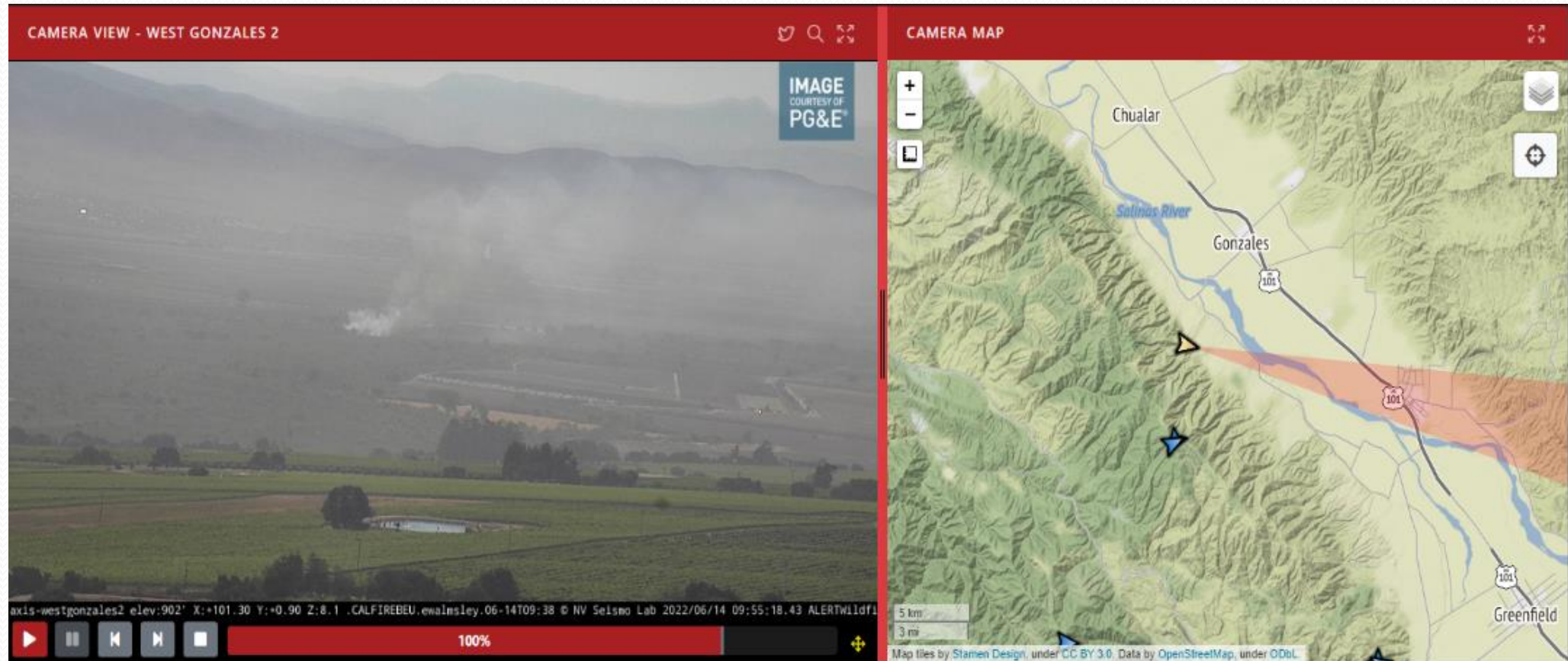
Clarity Air Quality Sensors

- ACCGJ2KB
- A1DSTCRF
- A300LRRV
- A3T32W43
- A4HX0Z3S
- A4RRSN0B
- A645NCG8
- A9BHX0FH
- AC057370
- AFKFBN67
- AFY3X8X3
- AG07B6LV
- AH3S5LT8
- AHLN14H6
- AK8C0HDZ
- AKH03534
- ANNZGV7C
- ANPZ34P3
- APPWHRLG
- AQQ4M3SG
- AS4L7TDD
- ASM0JMLJ
- ATW1DBCF
- AV0RKFK7
- AV20N0SR
- AWL3RVGH
- AY989QV6
- AYF7FWBQ
- AYW1PRKD

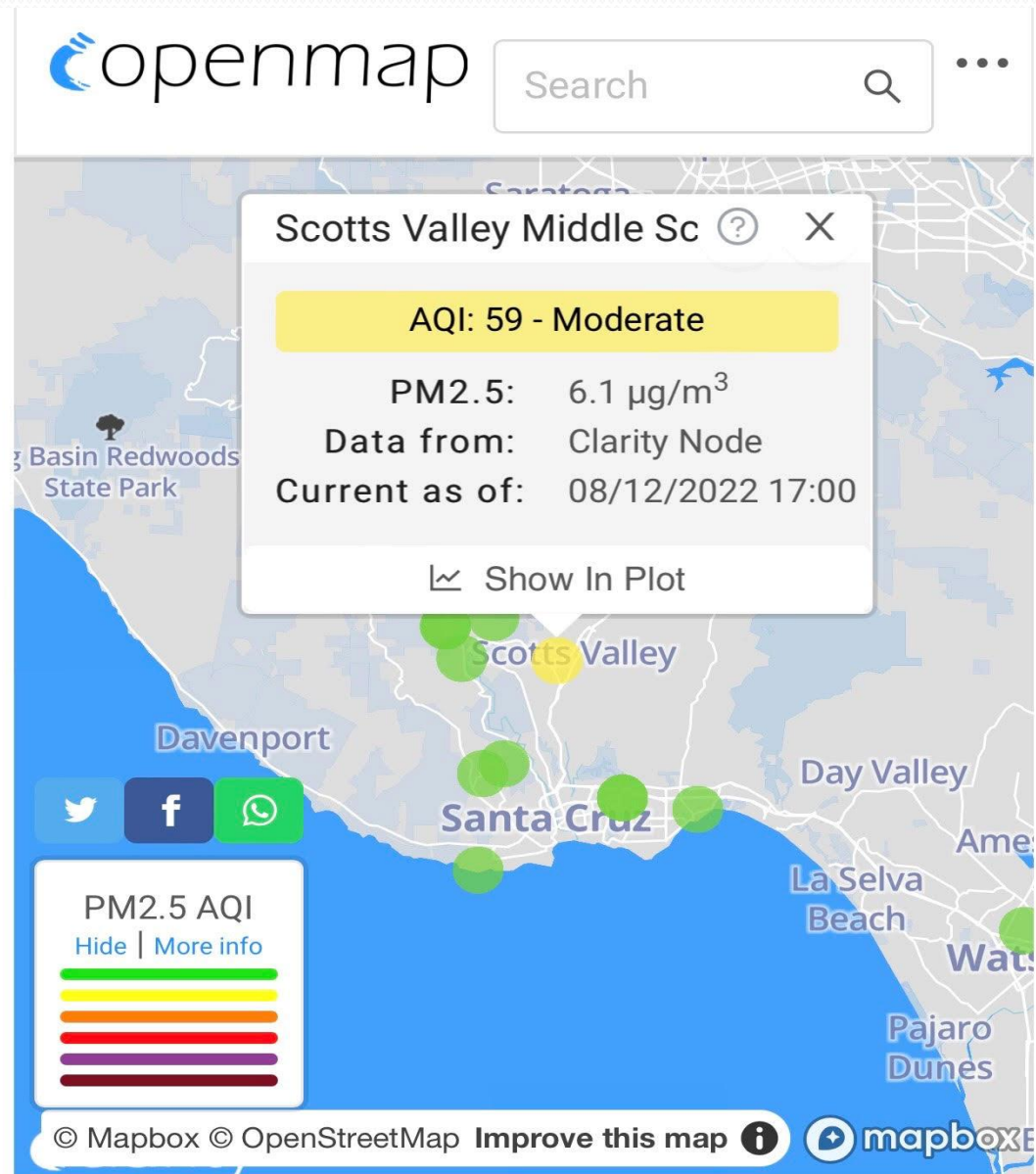


<https://www.arcgis.com/apps/dashboards/5a76ede4257d44f48d29e655c02aeae7>

Soledad – 6/14/22



Scotts Valley Wildfire - 8/12/22



Challenges

- One sensor missing
 - Need to label sensors with contact info
 - Approval/written agreements at locations where installed
- Fence with sensor attached fell over in recent storms – damaged sensor
- Standard maintenance to remove spider webs, clean solar panels
- Forested areas in narrow valleys – potential impacts from wood smoke
 - Difficult to operate – not enough sunlight for solar panels
- Programming for map publishing has proven to be challenging

Data Quality

Data Quality Meets Program Needs

- Control over location, proximity to sources, and data averaging
- Increased distribution – better resolution of monitoring data
- Increased insight into smoke impacts in other parts of region
- Satisfied other program requirements
 - Prescribed fire
 - Disadvantaged and Low-Income Areas (AB617)
 - Replaced seasonal monitoring for “Spare the Air” program
- Maps are insufficient - Communicate Risk

Discussion and Questions...

