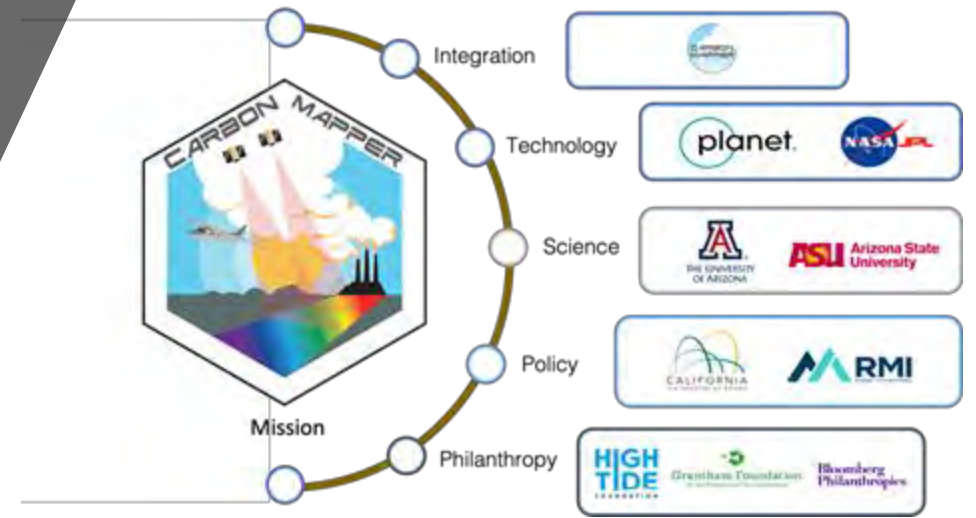# Carbon Mapper Overview

Dan Cusworth +
Carbon Mapper Team

Science Director
Carbon Mapper

What is Carbon Mapper?

- Carbon Mapper is a non-profit working to deliver actionable, localized CH_4 and CO_2 data

- Carbon Mapper leads a public-private partnership to develop and deploy emissions detecting satellites.

- **Tanager-1 launched Aug 16, 2024: plan to complete commissioning Jan 2025**

- Long-term goal: Scale to a full constellation to track 90% of high emitting CH_4 & CO_2 point sources globally

- Work with industry, governments, and other stakeholders to translate data into action

- All CH_4 & CO_2 data publicly available

Integration
Technology planet. NASA JPL
Science The University of Arizona ASU Arizona State University
Policy CALIFORNIA RMI
Mission
Philanthropy HIGH TIDE Grantham Foundation Bloomberg Philanthropies

Mission: Carbon Mapper, Methane Leak Detection
Location: Permian Basin, Southwestern United States

# Carbon Mapper planned tasking deck for 2 satellites

- Mean time to access (MTTA) < 7 days for isolated areas of interest (AOIs) in mid-latitudes
- Can work to develop custom AOIs for tasking related on impact, stakeholder, and coordinated observations
- As the constellation grows, we will be able to increase the rate of monitoring

All CH4/CO2 data made publicly available on Carbon Mapper's data portal

Planned tasking deck for 2 Carbon Mapper – Tanager satellite
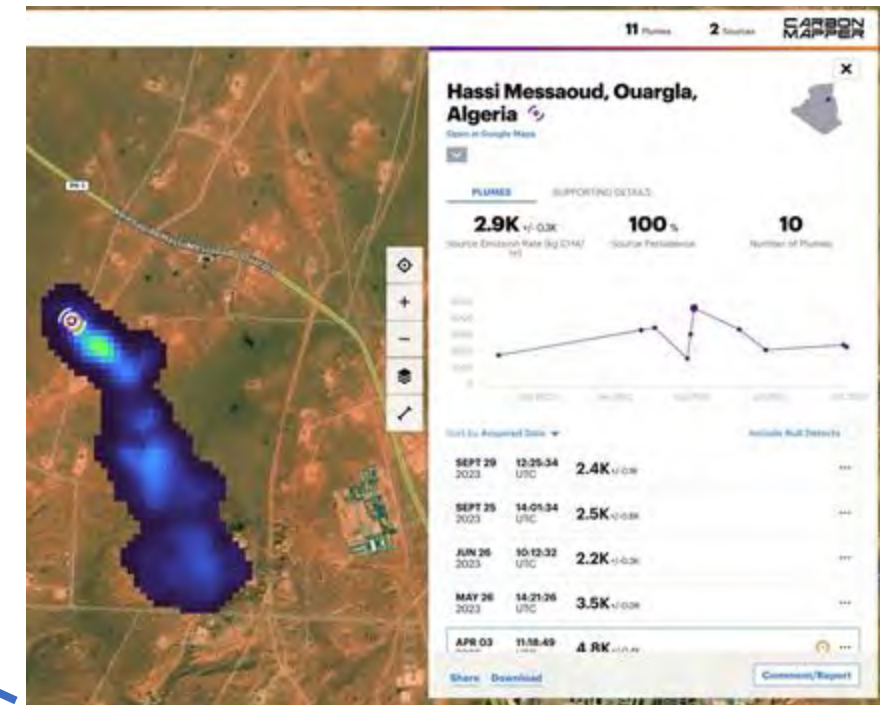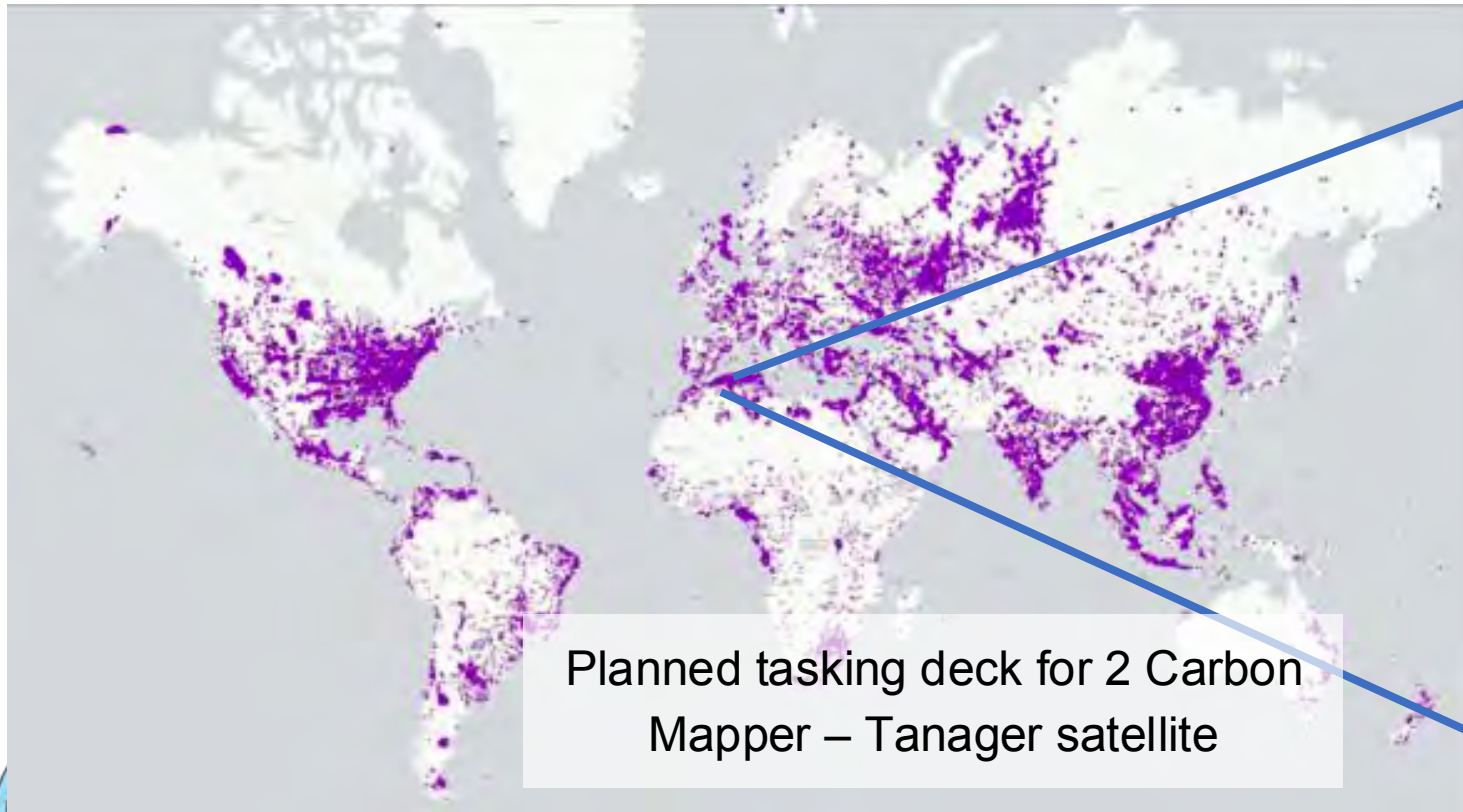
Global Data Portal: Enhanced Access and Insights

- Now over 14,000 methane plumes and over 800 CO_2 plumes published - Airborne and EMIT
- Improved plume visualizations
- Trend emission rates over time - and verify leak repairs
- Summary statistics for regional and sector-specific insights
- User-specified areas of interest
- Public API access

Portal: data.carbonmapper.org
API: api.carbonmapper.org
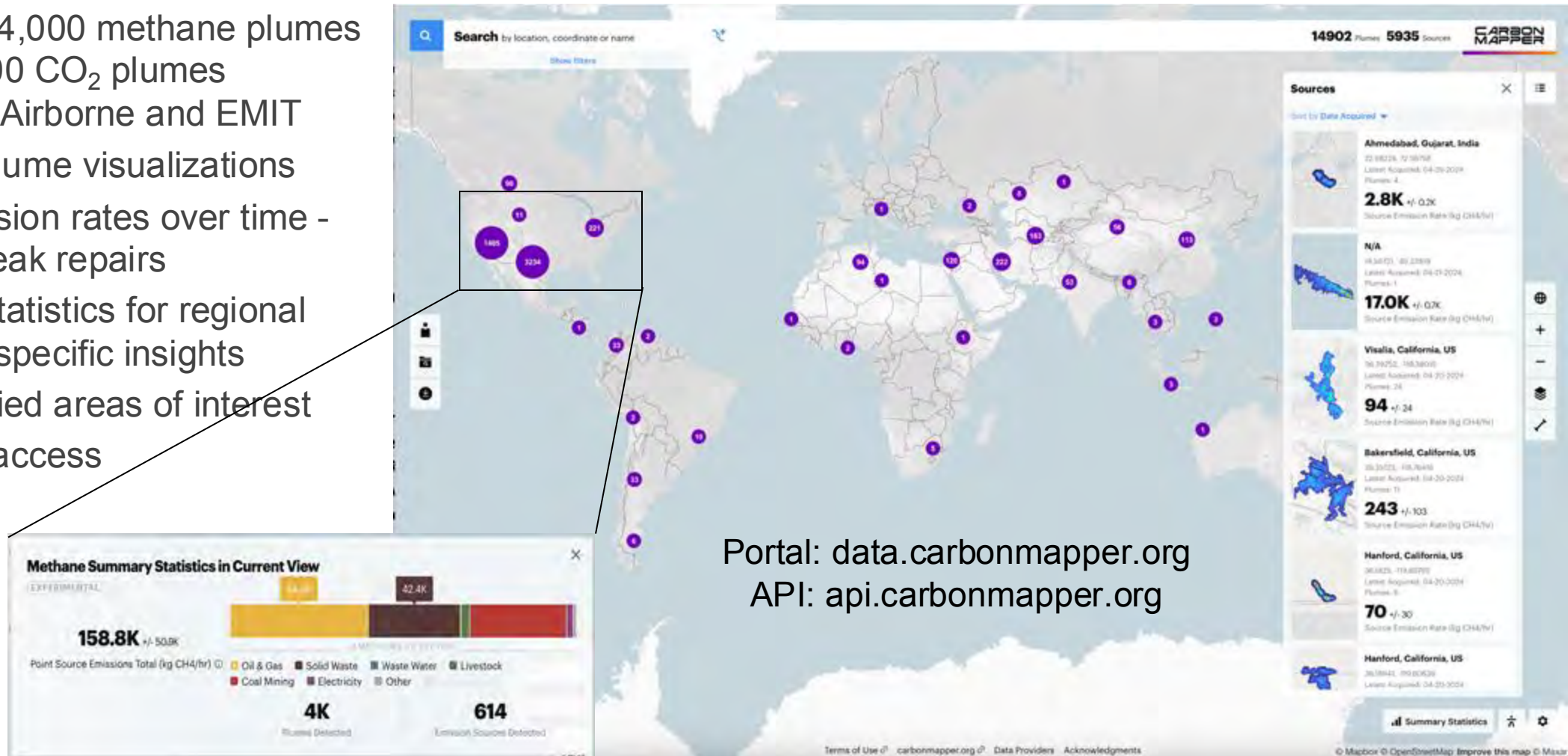
Carbon Mapper's methods for detection and quantification are published in the scientific literature and supported by in-field tests

We produce an emission estimate for each methane plume and use plume imagery to attribute the emission to a source to within 10 to 50 meters
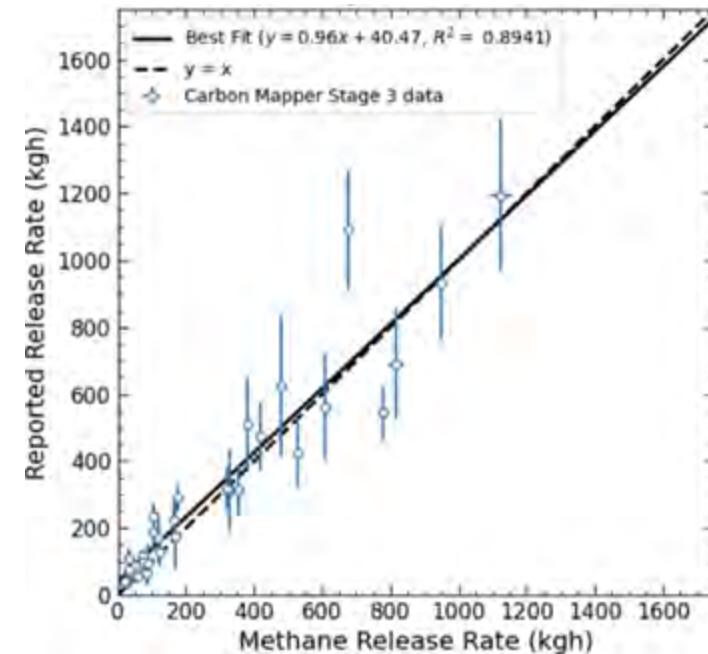
In single-blind controlled experiments with Stanford, Carbon Mapper's measured emission rates are well correlated with actual emissions

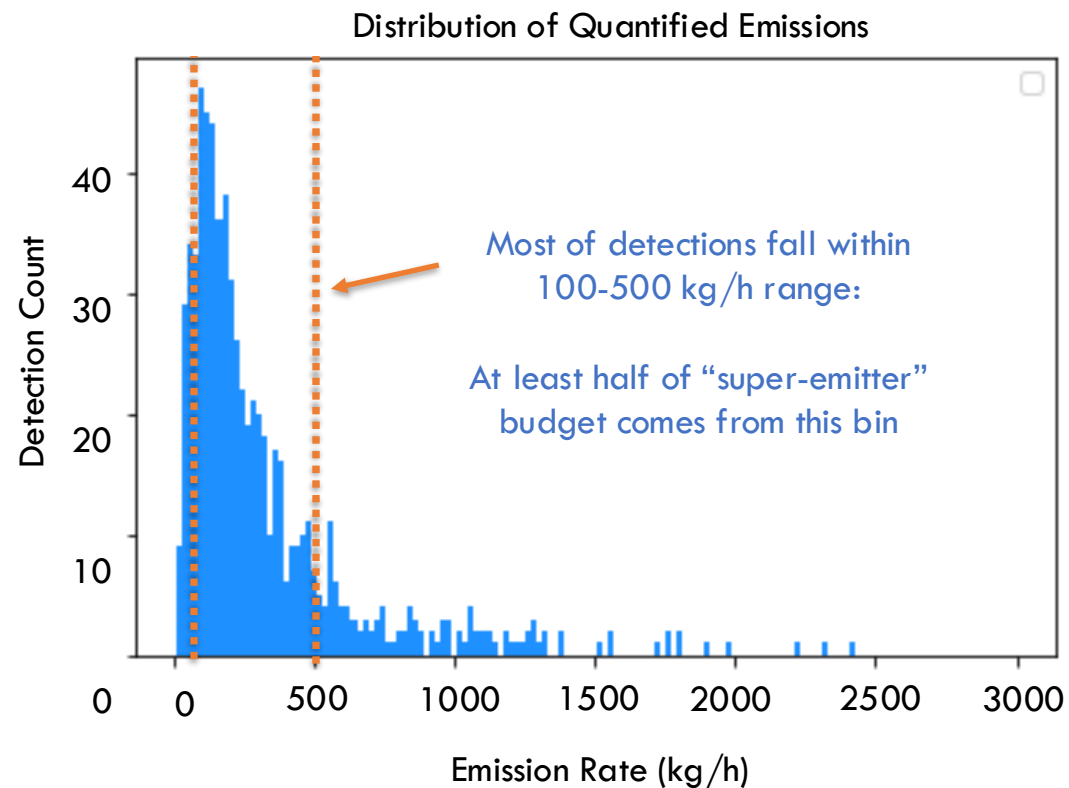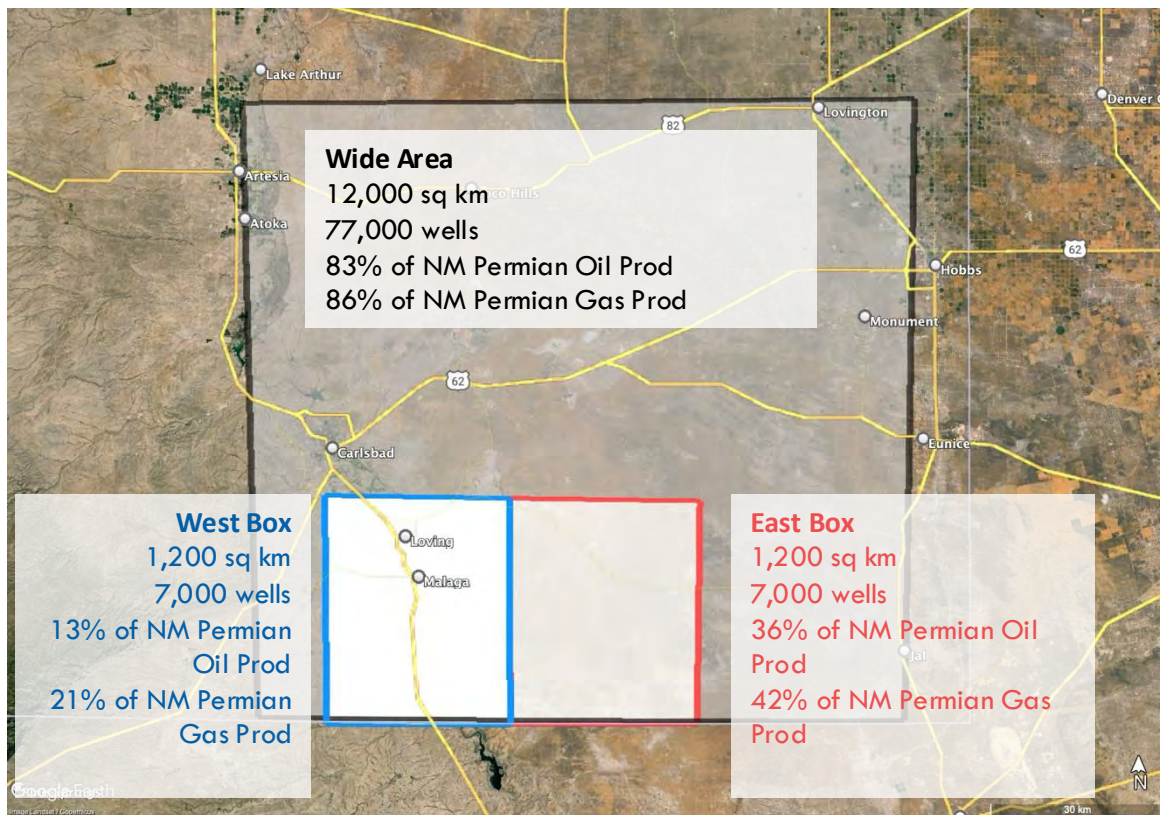1. Methane detection

2. Methane plume delineation

3. Emission rate quantification

4. Source attribution

Important of detection limit and spatial coverage in assessing contribution from super-emitters on basin-level emissions

2024 Airborne campaign in Permian Basin

Wide Area
12,000 sq km
77,000 wells
83% of NM Permian Oil Prod
86% of NM Permian Gas Prod

West Box
1,200 sq km
7,000 wells
13% of NM Permian Oil Prod
21% of NM Permian Gas Prod

East Box
1,200 sq km
7,000 wells
36% of NM Permian Oil Prod
42% of NM Permian Gas Prod

Distribution of Quantified Emissions

Most of detections fall within 100-500 kg/h range:

At least half of "super-emitter" budget comes from this bin

Need for wide area surveying at sufficiently low detection limit to appropriately understand impact of super-emitters

CARBON MAPPER

Research collaborations with academics and agencies to provide stakeholder and policy-relevant context to satellite observations

- **Oil & Gas. Carbon Mapper, Stanford, Insight M**: Combine Carbon Mapper data with process-model to estimate basin-level and super-emitter intensities for major oil&gas basins (Sherwin et al., Nature, 2024)
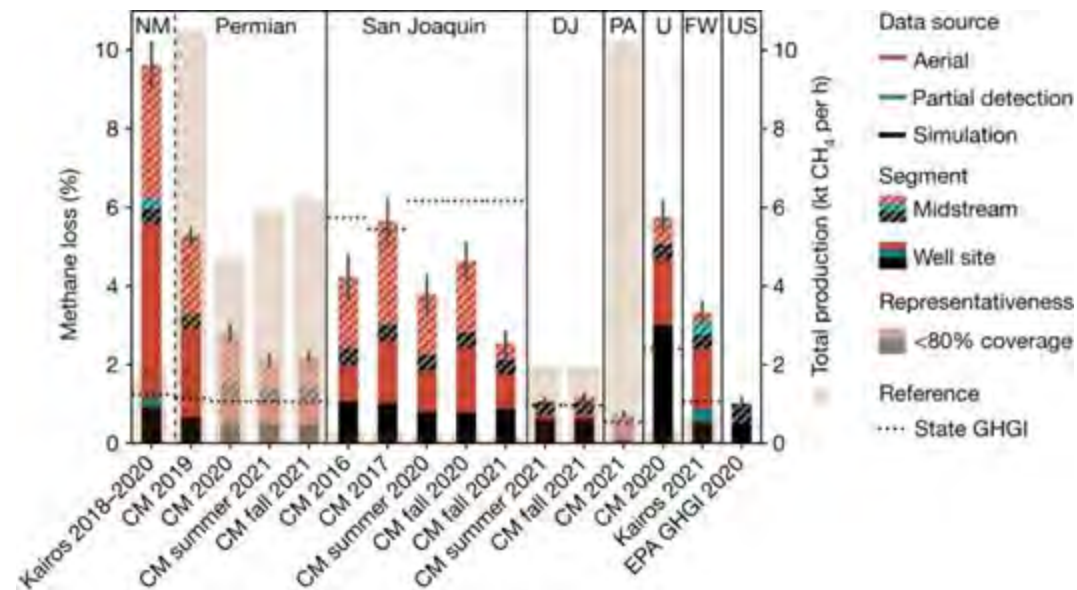
- **Waste. Carbon Mapper, EPA Office of Research and Development**: Coordinate observations and attribution emissions to activities across wide array of U.S. landfills. (Cusworth et al., Science 2024; Scarpelli et al., submitted)

Simultaneous landfill observations with GAO and Scientific Aviation
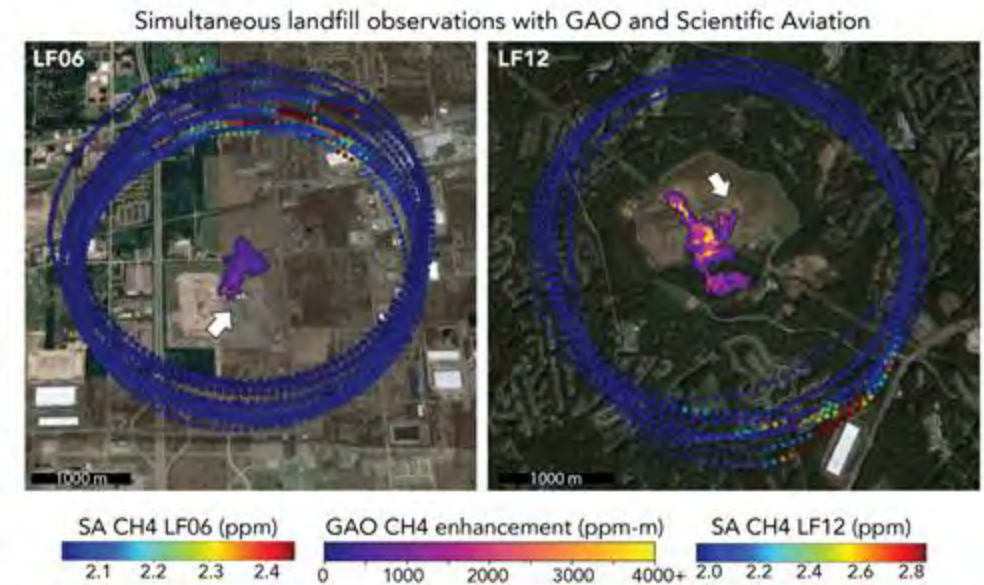
Work closely with governments and stakeholders to inform national, regional and local policies and mitigation

- EPA cited CM research and data in the updated supplemental O&G methane rule as well as in its recent update on emissions reporting for O&G and landfills

- CM has been working alongside several NGOs to push for updated EPA regulations on waste methane

- CM is a member of the the LOW Methane initiative led by the CCAC, C40 and the US State Department as part of its data working group to help jurisdictions get access to the data they need

- CM staff continue to testify before congress and brief policy makers at high-level events (US-China dialogue, Whitehouse Methane Summit, etc)
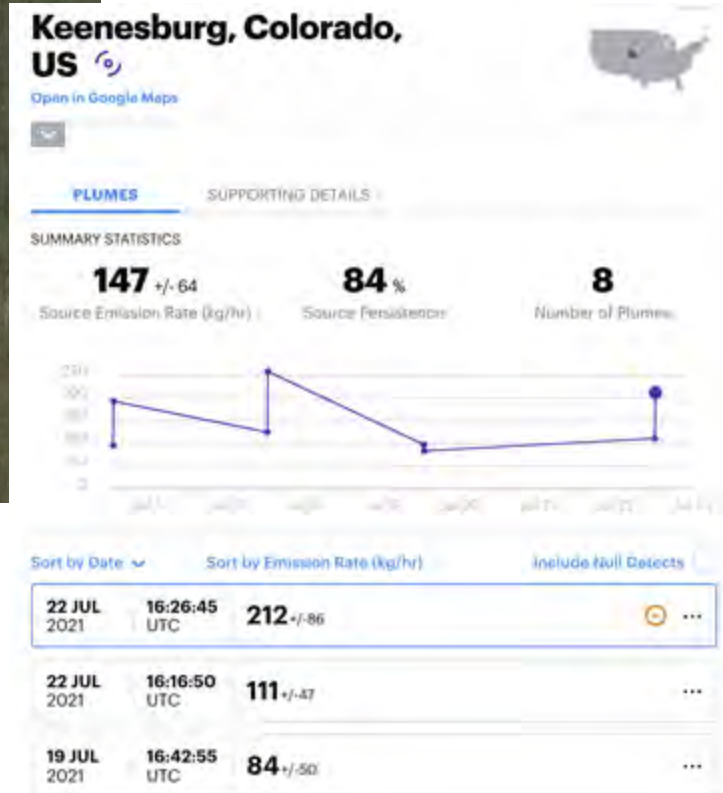
Collaborate with facility operators and states to deliver mitigation successes

Carbon Mapper has worked with other regulators and operators across the US (California, Colorado, Pennsylvania, and New Mexico in particular) to use this data to drive and verify mitigation actions

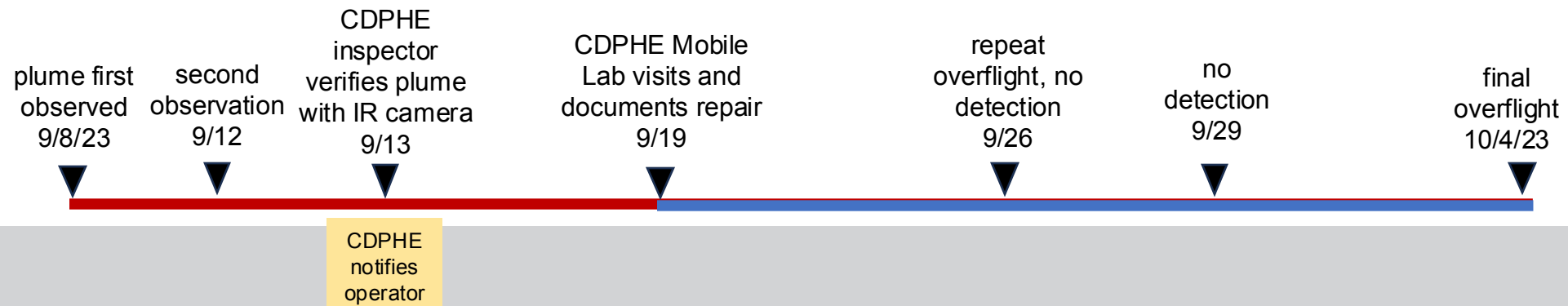**Gathering line in Colorado**

Mitigated due to detection

Keenesburg, Colorado, US

Open in Google Maps

PLUMES SUPPORTING DETAILS

SUMMARY STATISTICS

147 +/- 64
Source Emission Rate (kg/hr)

84 %
Source Persistence

8
Number of Plumes

Sort by Date ⌄   Sort by Emission Rate (kg/hr)   Include Null Detects

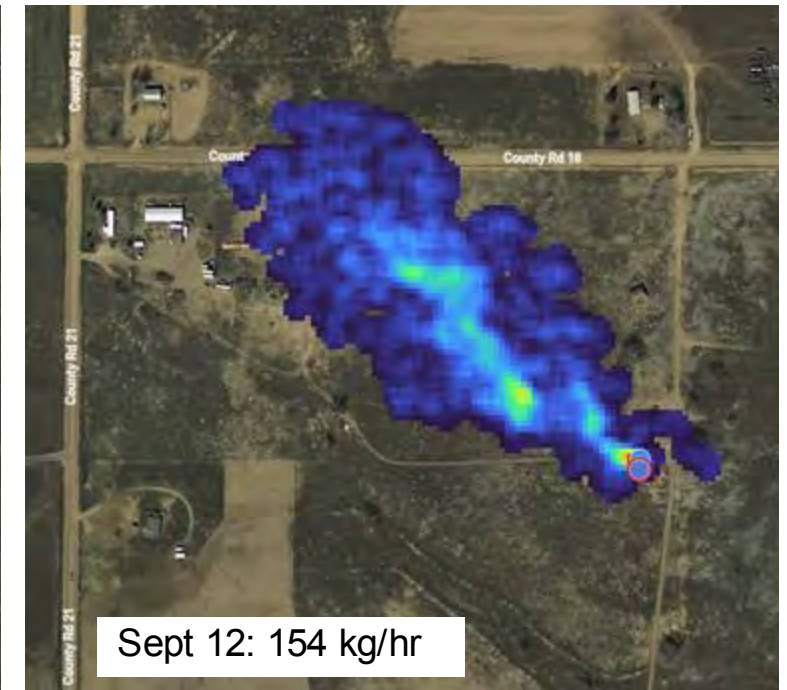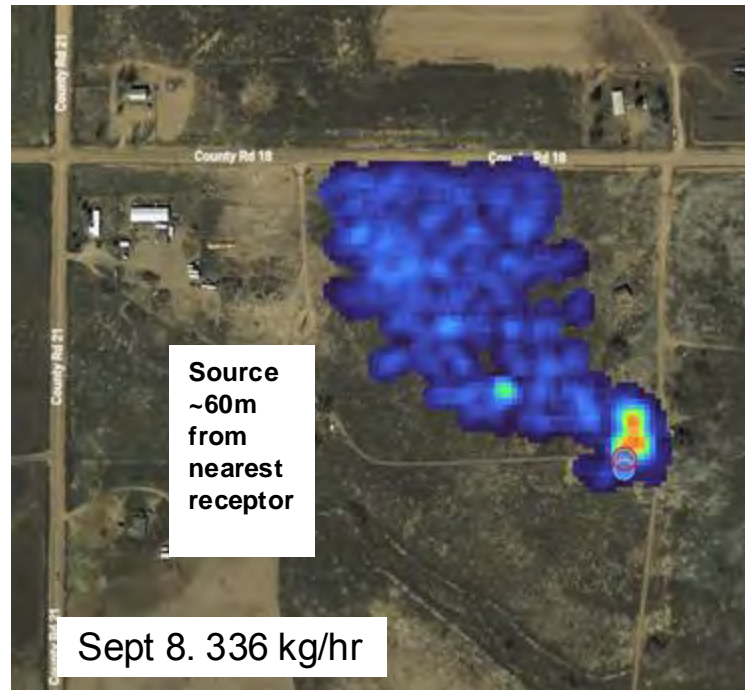| 22 JUL 2021 | 16:26:45 UTC | 212 +/-86 | ⊙ ... |
| 22 JUL 2021 | 16:16:50 UTC | 111 +/-47 | ... |
| 19 JUL 2021 | 16:42:55 UTC | 84 +/-50 | ... |

Remote sensing helped identify emission causes and validate mitigation improvements at a leaky landfill

Before March 2017

After October 2017

2023 airborne campaign in Colorado: CDPHE shared Carbon Mapper data with operators - led to at least 3 tons/hr of mitigation

Example of direct mitigation of potentially harmful source

newly built RV park

low producing well with pump jack and tanks

Source ~60m from nearest receptor

Sept 8. 336 kg/hr

Sept 12: 154 kg/hr

plume first observed 9/8/23

second observation 9/12

CDPHE inspector verifies plume with IR camera 9/13

CDPHE Mobile Lab visits and documents repair 9/19

repeat overflight, no detection 9/26

no detection 9/29

final overflight 10/4/23

CDPHE notifies operator

Collaboration opportunities

- Beyond publishing satellite data through our global data platform, our NGO has a significant focus on and investments in impact, stakeholder engagement, and (particularly in the US) regulatory support

- We're actively working with GMH and MethaneSAT on key collaboration areas and interested in expanding scope with other interested partners (e.g., coordinated observations with AiRMAPS). Examples:

  - Basin-level multi-tiered quantification

  - Using point measurements for attribution

  - Instrument cross-validation

- We should be available for further discussion and exploration later in 2024 / 2025 following launch and commissioning of Tanager-1

Thank You