Quantifying the Socioeconomic Benefits Derived from Applications of Earth Observations

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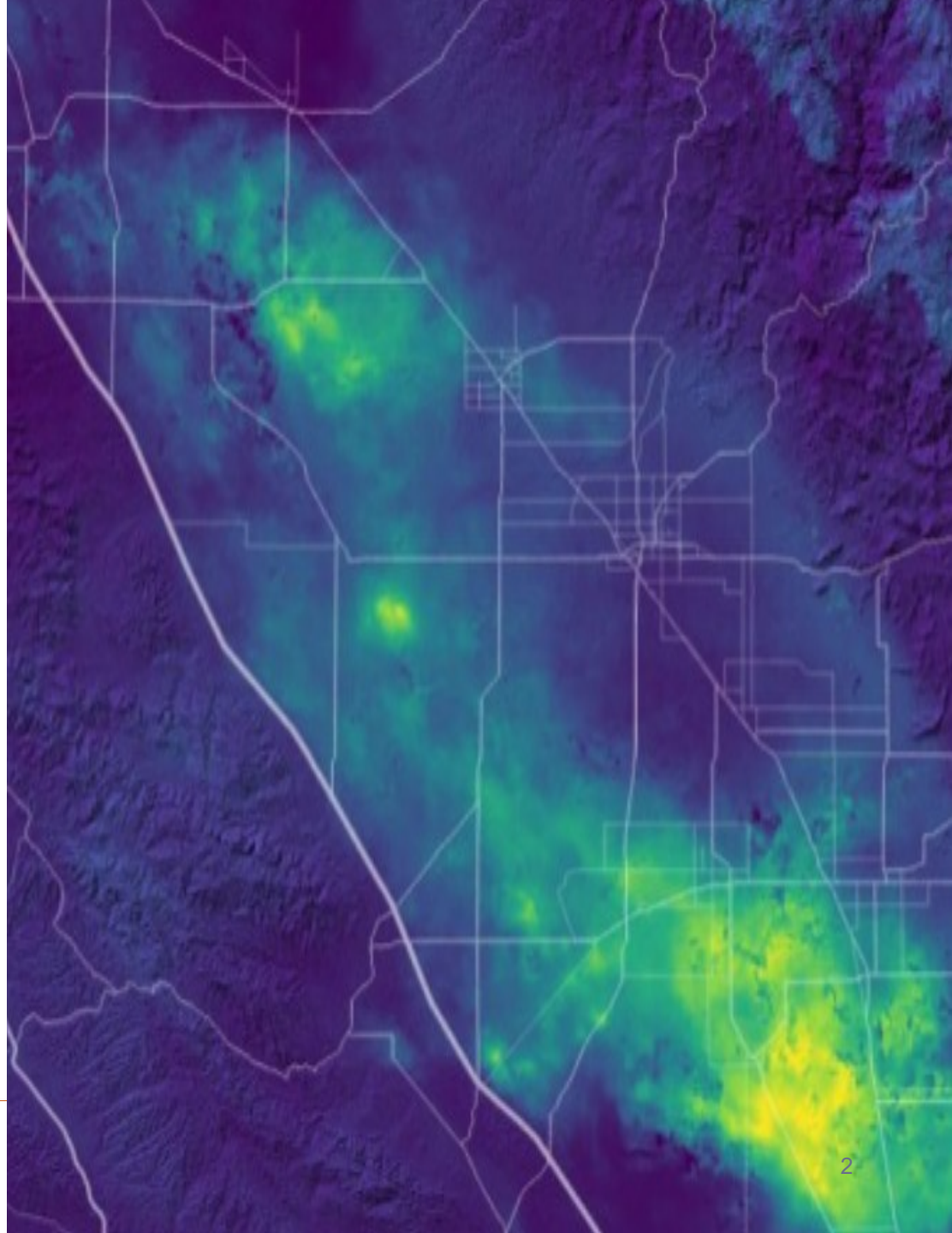
HAQAST3
November 28, 2017

RESOURCES FOR THE FUTURE

From *Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond* (NRC 2007):

"The design of space-based measurements that are tailored for particular applications is an important first step in achieving societal benefits. Developing the requirements for a given application involves better understanding of the scientific issues and the decision-making context within which the targeted measurements play a role. *The panel recommends that development of future Earth science mission strategy include social science research into the key drivers of measurement needs for societal decision making.*" (Page 148)



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NASA, VALUABLES, and socioeconomic benefits

- For new knowledge and as a strategic pursuit, NASA's Earth Science Division considers it important to substantiate the benefits of Earth science applications in socially and economically meaningful terms, and to communicate those benefits to audiences beyond the Earth science community.
- NASA's Applied Sciences Program has sought to advance socioeconomic assessments of Earth science, both to expand knowledge and to induce broader interest in Earth observations applications.
- VALUABLES will engage and collaborate with NASA Earth mission science teams in building familiarity and capacity with socioeconomic impact evaluations/assessments, terms, concepts, and methods.

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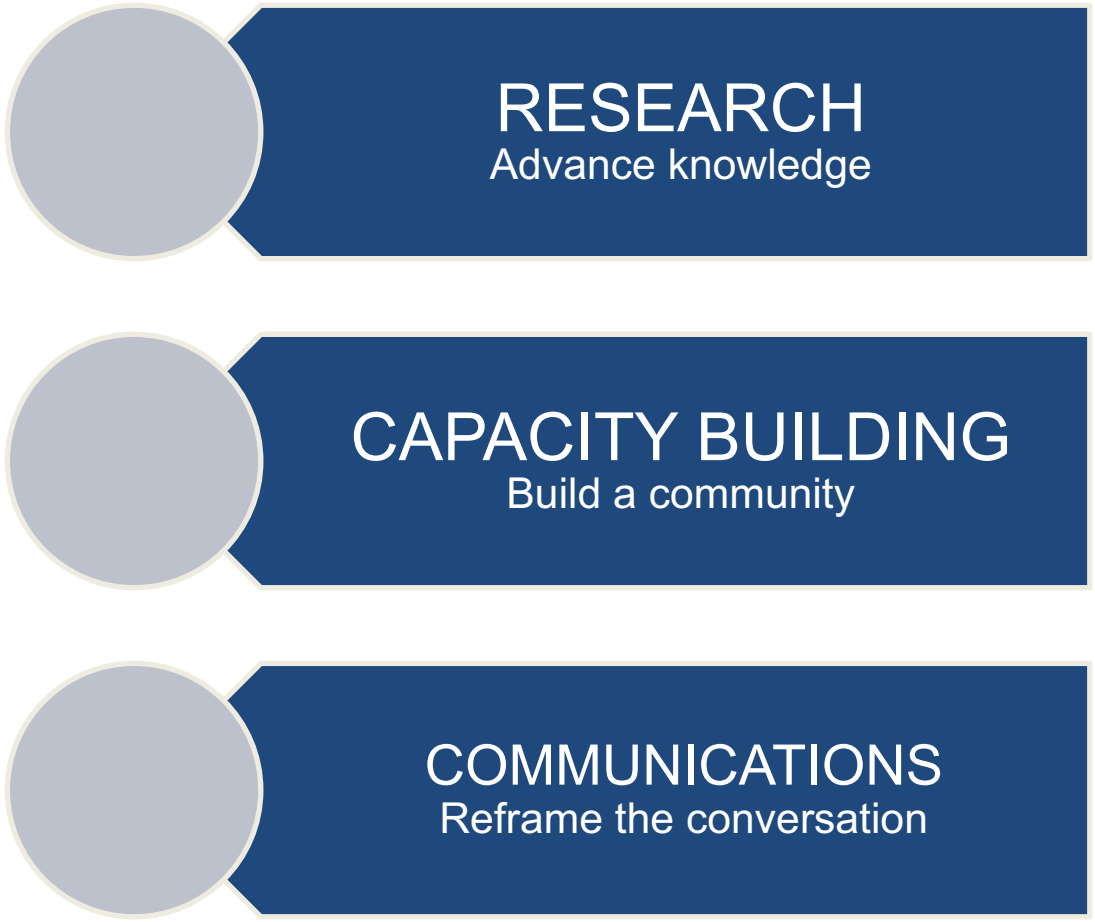
Three “pillars” of the VALUABLES Consortium

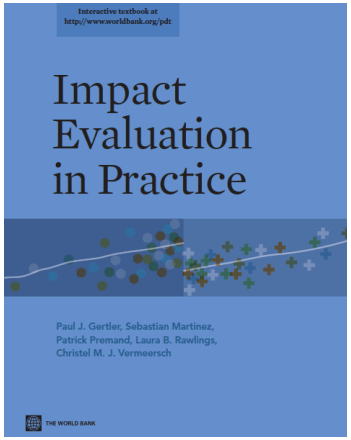


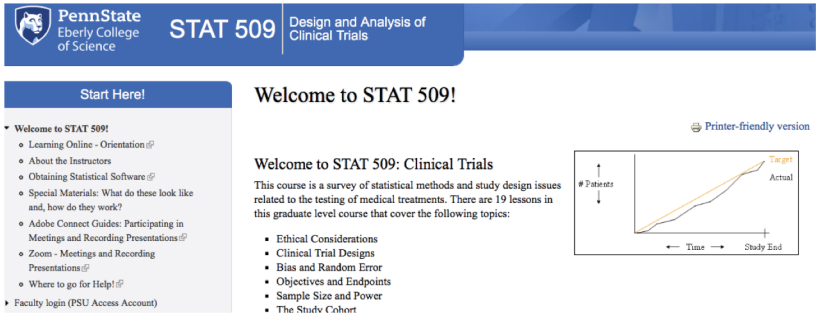
What is an impact assessment/evaluation?

Involves six tasks:

1. Clarify impacts, outcomes, and beneficiaries
2. Identify metrics for outcomes and impacts
3. Develop a theory of change
4. Design an empirical strategy
5. Implement the empirical strategy
6. Synthesize and report evidence

A theory of change describes the causal logic of how and why a particular project, program, or policy will reach its intended outcomes



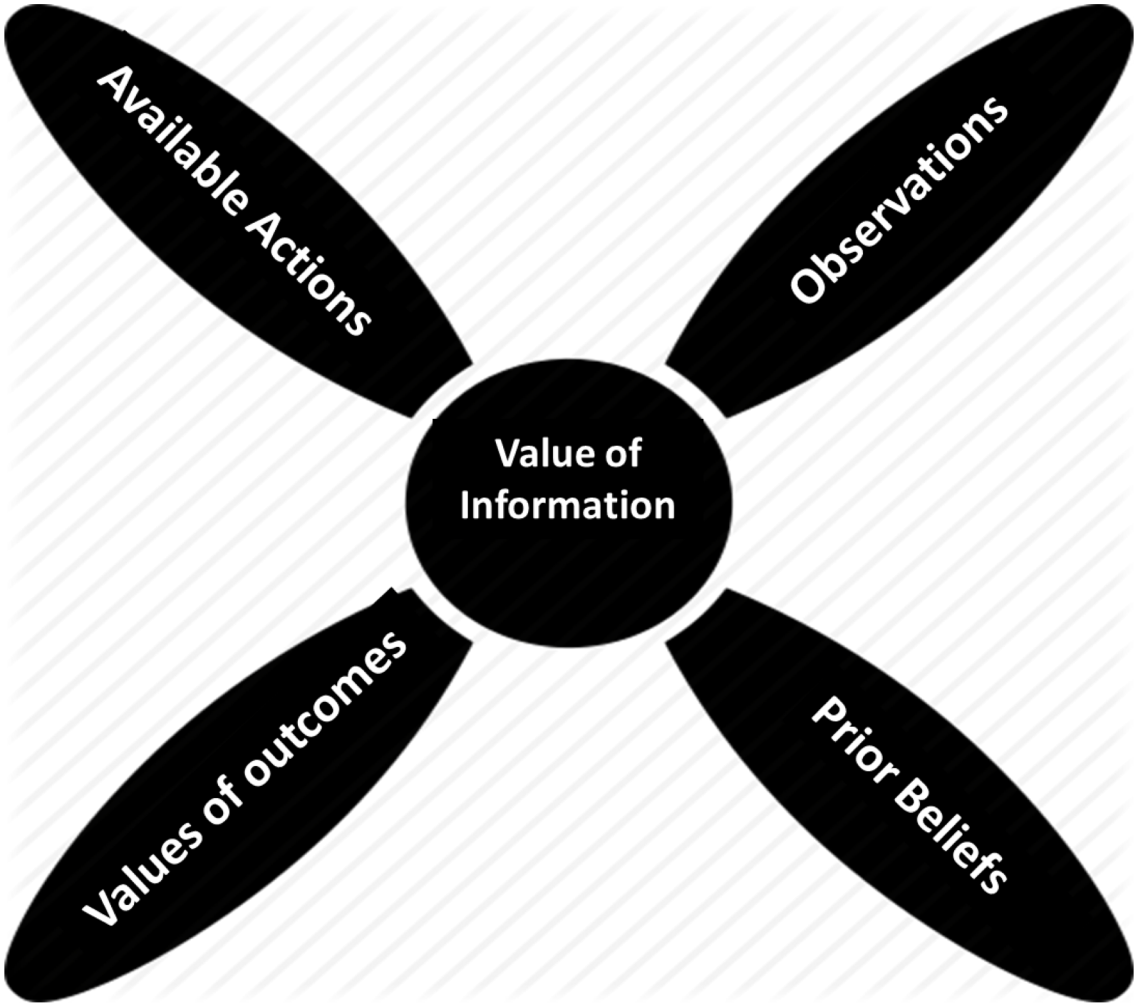


"The data helped in deployment of disaster relief"

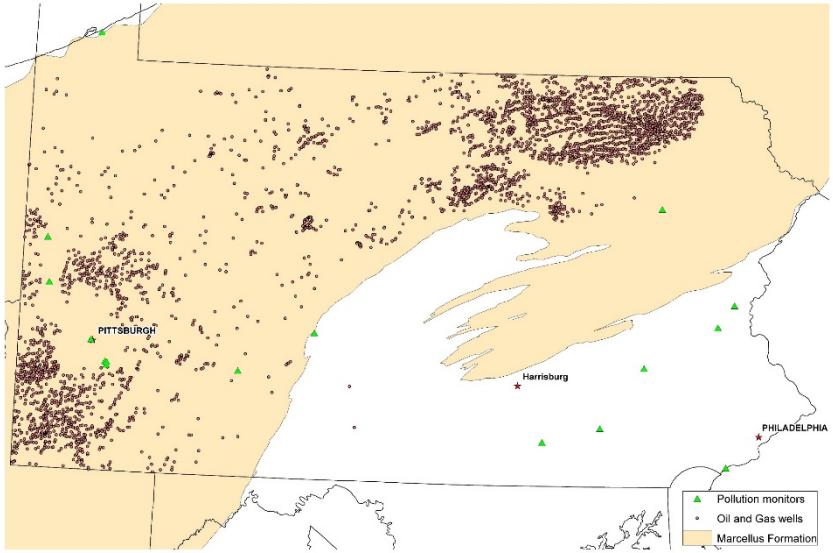
vs.

"The availability of data within two hours at 10 km resolution allowed deployment of disaster relief twice as fast as without the data and enabled an estimated x% more lives to be saved, valued at $y."

The “Value of Information Propeller”

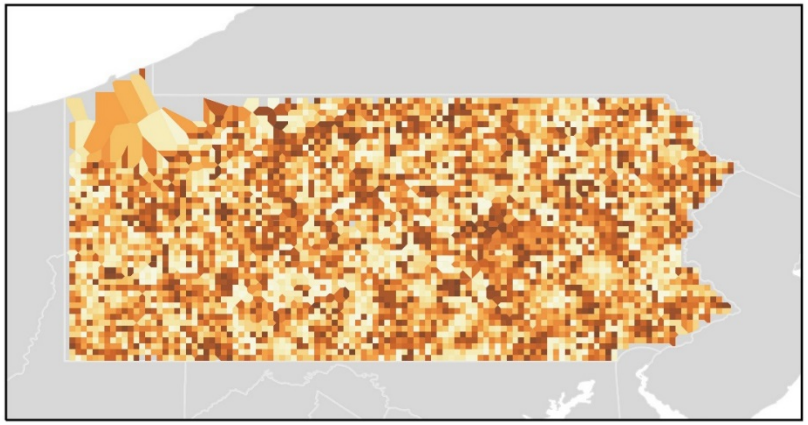


Example 1: Improving the regulation of unconventional oil and gas development (Sullivan and Krupnick 2017)



Natural gas wells and PM monitors in PA

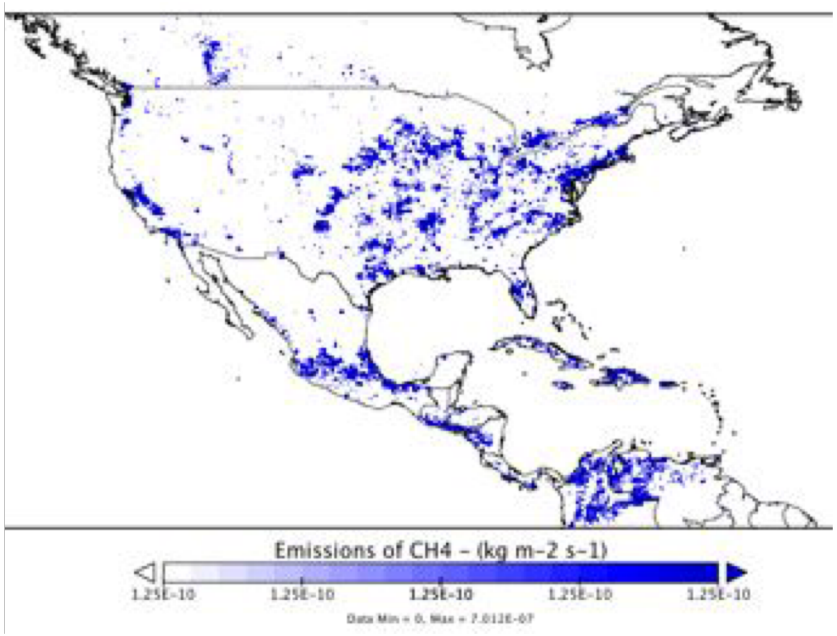
Spatial resolution: 16 pollution monitors
Temporal resolution: Hourly readings every sixth day



MODIS PM (AOD) readings (Jan. 2012)

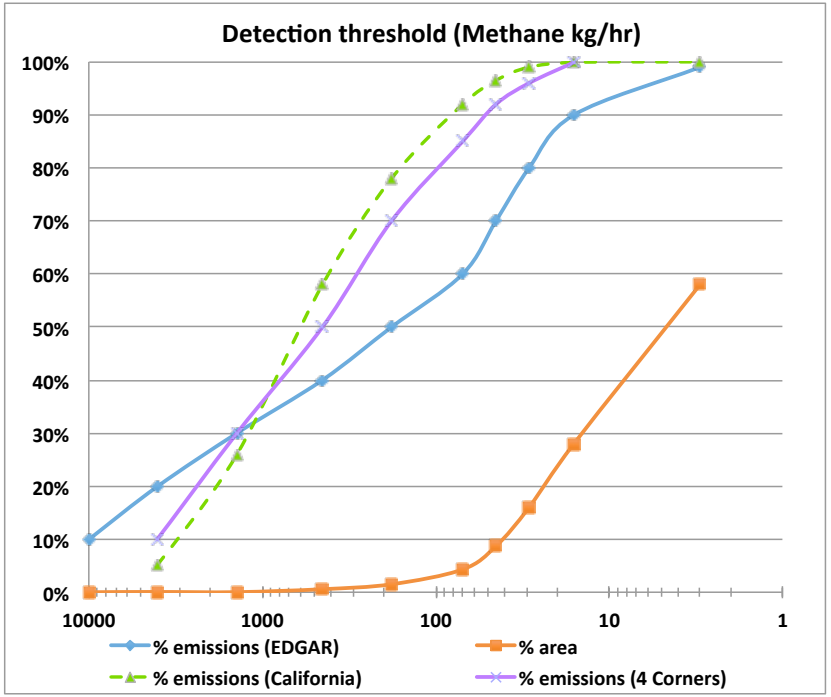
Spatial resolution: 15 km on average
Temporal resolution: Once per day

Example 2: Characterizing the relationship between temporal/spatial resolution and mission cost in a decision context (Krupnick, Zachary, and Duren 2017)



EDGAR 4.2 Global Gridded Methane Emission Inventory

Currently the only global gridded methane emission inventory available.



Relationship between coverage and detection thresholds

For the various technologies, achieving an 80% completeness target requires a sensitivity of 35-180 kg CH4/hr detection threshold.

Example 2: Characterizing the relationship between temporal/spatial resolution and mission cost in a decision context (Krupnick, Zachary, and Duren 2017)

Methane detection limits and costs for missions to cover 80% of global point sources

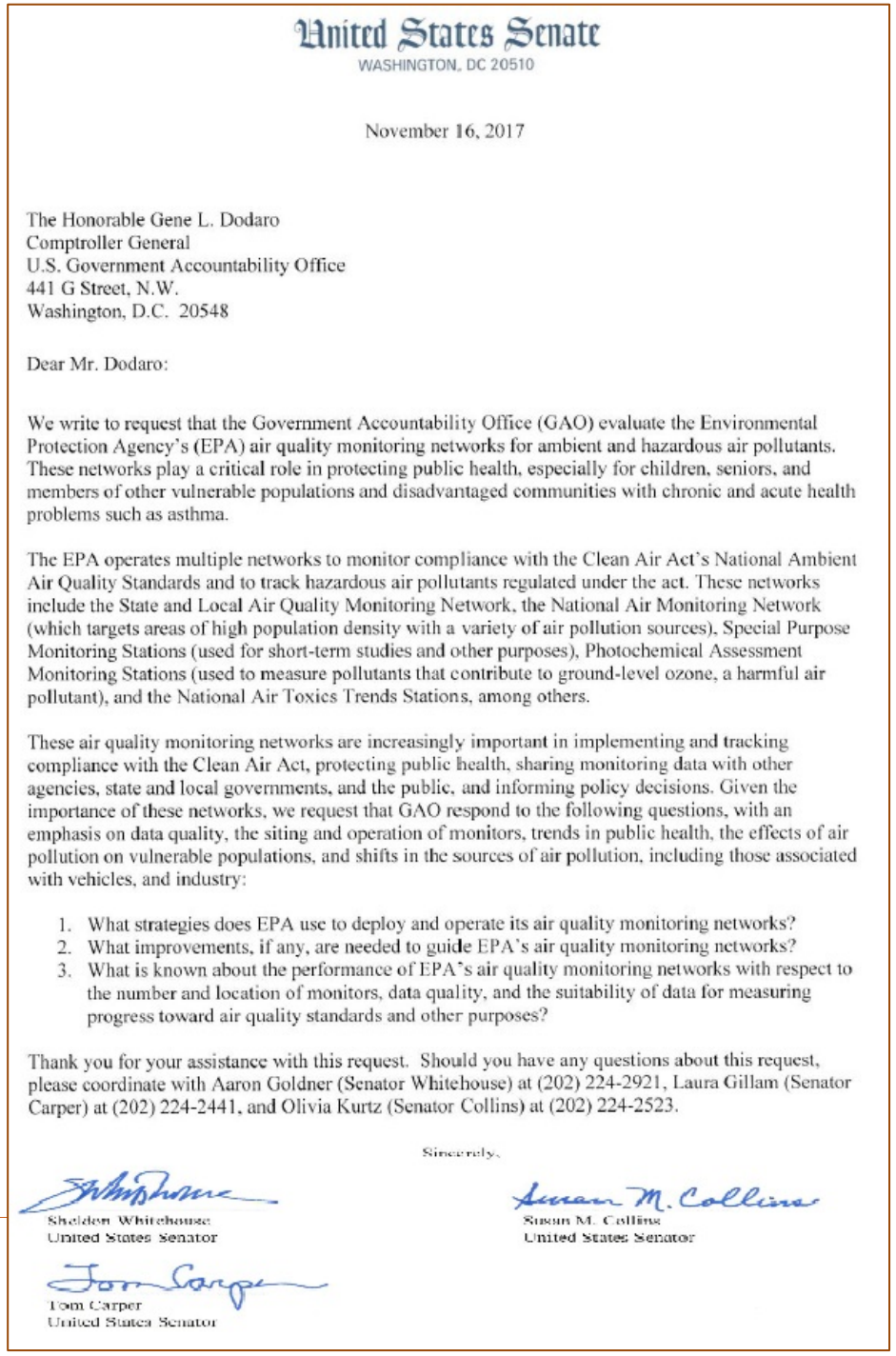
Mission	Status	Orbit Type	Pixel size [km], W	Precision [%]	Precision [ppb], σ	Reference	Detection limit [kgCH4/hr], Qmin	Equivalent Annual Emissions [ktonsCH4/year]	% Completeness (sensitivity only; 2.5 m/s)	# Instruments for Mission (10 day revisit cover 80% global point sources)	Total Mission Capital Cost ($M)	Total Mission Annual Operating Cost ($M/yr)
TROPOMI: Global sounder (with Sentinel 5P per Instrument)	launched 2017	Polar Orbiter	7	0.60%	11	Butz et al (2012)	7,656	67.1	<10%	2	$ 600	$ 40
GeoCARB: Regional mapping spectrometer	funded, launch TBD	Geo-stationary	4	1.0%	18	Polonsky et al (2014)	7,291	63.9	<10%	3	$ 450	$ 30
CarbonSat: Global sounder	proposed	Polar Orbiter	2	0.4%	7	Buchwitz et al (2013)	1,458	12.8	25%	2	$ 500	$ 40
GHGSat: constellation of imaging spectrometers	Prototype 2016; Assumptions for proposed constellation performance	Polar Orbiter	0.05	15-30%	270-540	unpublished*	1400-2700	12-24	10-25%	20	$ 150	$ 40
CEMSat: constellation of imaging spectrometers	proposed; potential fly by 2021	Polar Orbiter	0.02	3.5%	64	scaled from Thompson et al (2016)	129	1.1	85%	20	$ 250	$ 40

*unofficial reports on GHGSat precision range from 15-30%

Letter to GAO Comptroller General Gene Dodaro

1. "What strategies does EPA use to deploy and operate its air quality monitoring networks?"
2. "What improvements, if any, are needed to guide EPA's air quality monitoring networks?"
3. "What is known about the performance of EPA's air quality monitoring networks with respect to the number and location of monitors, data quality, and the suitability of data for measuring progress toward air quality standards and other purposes?"

Sens. Sheldon Whitehouse (D-RI), Susan Collins (R-ME), Tom Carper (D-DE)



United States Senate
WASHINGTON, DC 20510

November 16, 2017

The Honorable Gene L. Dodaro
Comptroller General
U.S. Government Accountability Office
441 G Street, N.W.
Washington, D.C. 20548

Dear Mr. Dodaro:

We write to request that the Government Accountability Office (GAO) evaluate the Environmental Protection Agency's (EPA) air quality monitoring networks for ambient and hazardous air pollutants. These networks play a critical role in protecting public health, especially for children, seniors, and members of other vulnerable populations and disadvantaged communities with chronic and acute health problems such as asthma.

The EPA operates multiple networks to monitor compliance with the Clean Air Act's National Ambient Air Quality Standards and to track hazardous air pollutants regulated under the act. These networks include the State and Local Air Quality Monitoring Network, the National Air Monitoring Network (which targets areas of high population density with a variety of air pollution sources), Special Purpose Monitoring Stations (used for short-term studies and other purposes), Photochemical Assessment Monitoring Stations (used to measure pollutants that contribute to ground-level ozone, a harmful air pollutant), and the National Air Toxics Trends Stations, among others.

These air quality monitoring networks are increasingly important in implementing and tracking compliance with the Clean Air Act, protecting public health, sharing monitoring data with other agencies, state and local governments, and the public, and informing policy decisions. Given the importance of these networks, we request that GAO respond to the following questions, with an emphasis on data quality, the siting and operation of monitors, trends in public health, the effects of air pollution on vulnerable populations, and shifts in the sources of air pollution, including those associated with vehicles, and industry:

1. What strategies does EPA use to deploy and operate its air quality monitoring networks?
2. What improvements, if any, are needed to guide EPA's air quality monitoring networks?
3. What is known about the performance of EPA's air quality monitoring networks with respect to the number and location of monitors, data quality, and the suitability of data for measuring progress toward air quality standards and other purposes?

Thank you for your assistance with this request. Should you have any questions about this request, please coordinate with Aaron Goldner (Senator Whitehouse) at (202) 224-2921, Laura Gillam (Senator Carper) at (202) 224-2441, and Olivia Kurtz (Senator Collins) at (202) 224-2523.

Sincerely,

Sheldon Whitehouse
United States Senator

Susan M. Collins
United States Senator

Tom Carper
United States Senator

Connect with us

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