



NASA Earth Science Division Equity & Environmental Justice Workshop Report

Executive Summary

NASA Headquarters Earth Science Division (ESD) identified four goals to frame an equity and environmental justice strategy for expanded engagement with communities, nongovernmental organizations (NGOs), philanthropies, academia, industry, and federal partners:

- **Goal 1:** Conduct assessments of current environmental justice engagements, barriers and gaps, and opportunities;
- **Goal 2:** Engage with a range of organizations involved with environmental justice communities and harvest lessons and potential partnerships for the strategy;
- **Goal 3:** Host data accessibility and utility sessions;
- **Goal 4:** Enable transdisciplinary science and applications that integrate physical and social science using NASA datasets.

To begin to address Goals 2 and 3, NASA ESD organized its first community listening workshop on October 20, 2021, entitled “NASA’s Equity and Environmental Justice Virtual Workshop”. The workshop, planned together with NASA’s Socioeconomic Data and Applications Center (SEDAC), focused on listening to representatives from social science research organizations who engage with environmental justice (EJ) research and communities.

The objective of the workshop was to identify priorities, gaps, barriers, and opportunities in using NASA data, research, and applications to address EJ and in support of EJ research and stakeholder communities. This report was prepared by the organizing team and summarizes the many views and inputs provided by the participants in the virtual workshop; however, all participants may not necessarily agree with every comment and suggestion, nor will suggestions or inputs discussed at the workshop necessarily be reflected in NASA’s strategic planning regarding EJ.

NASA ESD personnel listened to the approximately 15 external participants who came from a variety of organizations, including: Columbia University, George Washington University, Georgetown University, Howard University, the International Computer Science Institute, the Massachusetts Institute of Technology, Mercy Corps, RAND Corporation, Pennsylvania State University, Pew Charitable Trusts, Resources for the Future, the University of Virginia, the University of Michigan, the Urban Sustainability and Equity Planning Program, and the World Geospatial Industry Council.

Overall takeaways from the workshop include the following suggestions: a) Increase awareness of NASA Earth Observation (EO) data; b) Facilitate communication and involvement between NASA and EJ communities; c) Improve NASA Earth observing data’s availability, resolution, and ease of use. Workshop participants noted it is important to listen to communities to understand

their needs and perspectives. There is a need to make data “analysis ready” for social science and EJ researchers, to consider priority time frames for accessing and integrating data, and to consider flexible tools and interfaces to reach diverse audiences. Important research and applications activities remain to increase understanding of environmental justice and to develop applications alongside EJ communities for their use.

Workshop Organization and Structure

The virtual workshop took place on Zoom. The organizational team included three representatives from NASA Headquarters--one each from NASA ESD’s Applied Sciences, Data Systems, and Research & Analysis programs--and three from SEDAC--SEDAC’s manager, deputy manager, and project scientist. Following an introduction and overview by organizers and the NASA ESD Director, participants joined two rounds of breakout sessions with three breakout groups each, featuring facilitated small group discussions.

The purpose of having two rounds of breakout sessions was to first highlight thematic EJ issues and challenges, and then to reorient discussion on potential ways applications, data, and research could address these issues. The first set of breakout sessions focused on “Needs and Priorities” of EJ communities, with participants separated into three thematic Zoom rooms: 1) human health; 2) climate, adaptation, and resilience; and 3) disasters. The second breakout session focused on “Solutions and Opportunities,” with participants separated into three Zoom rooms focused on solutions and opportunities provided by: 1) applications, 2) data, and 3) research. A Google Jamboard digital whiteboard enabled all participants to share and document ideas in different topical categories.

Following each round of breakout sessions, key takeaways were presented during a plenary discussion, which allowed for input from the wider group and identification of potential gaps and overlaps.

Target Questions

In advance of the workshop, organizers provided participants three questions for each of the smaller breakout groups to discuss, as follows:

Session 1: Needs and Priorities (thematic Zoom room discussions)

1. What is your perspective regarding the needs and priorities of historically underserved and marginalized communities in relation to equity and environmental justice? [Applied to Human Health; Climate, Adaptation & Resilience; or Disasters]
2. What is the nature of the equity and environmental justice problems you are addressing and how might NASA [data/research/applications] help?
3. What do you wish you knew? What would be a game changer?

Session 2: Solutions and Opportunities (Data, research, and applications Zoom rooms)

1. Imagine you could wave a magic wand where no money is involved and technology wasn't a constraint. What sort of data would make the most impact to improve equity and environmental justice?
2. From your perspective, which of the sectors listed could best use geospatial data to advance equity and environmental justice? Sectors considered include academia, research institutions, local governments, state/provincial governments, federal/central governments, intergovernmental organizations, consortiums, private sector (for-profit), private sector (non-profit)/voluntary or NGO, tribal entities, and other.
3. Are there key social science datasets that would make a huge impact if they were integrated or processed to enable better geospatial integration?

Overview of Workshop Suggestions & Feedback

During the workshop breakout and plenary discussion sessions, participants provided a total of 112 notes on the Google Jamboard. Responses largely fell into three categories:

Category A: Increase awareness of NASA Earth Observation (EO) data

Category B: Facilitate communication and involvement between NASA and EJ communities

Category C: Improve NASA Earth observing data's availability, resolution, and ease of use

Category A: Many comments highlighted the need for increased awareness of existing NASA EO data within the EJ community. Participants noted that NASA data were not as well-known as NOAA's weather data to the community. Additionally, the research community needs more help understanding the strengths and weaknesses of how EO data can address EJ community needs. For example, EO data can help improve characterization of the context and dynamics of human exposure and vulnerability to environmental extremes, stresses, and/or pollution, drawing on better data on infrastructure, population movement, and indoor/outdoor work or activities. People do look to NASA as a source of innovative data, tools, visualizations, etc., but recognize that other agencies and entities may need to take the lead, and NASA should try to collaborate with those agencies in advance.

Category B: Comments and feedback related to the need for more communication and engagement between NASA and EJ communities appeared throughout the workshop. Participants underscored the need for more situational awareness about EO data and its current and potential use by EJ communities. More community engagement would provide an opportunity for NASA to learn more about specific community needs. Several participants expressed the need for broader community involvement in earlier stages of data, research, and

application development, as a way to more successfully address community needs and increase interest and uptake by the EJ community. In addition, involving experienced practitioners as intermediaries can help in this process.

Category C: NASA EO data's availability, resolution, and ease of use were also raised in all three discussion sessions. Participants identified the need for more data at neighborhood-level scales to be useful in addressing EJ-related issues. Another concern is that NASA data tends to be used mainly after disasters or for visible problems - but NASA data are also potentially valuable for EJ communities before disasters, e.g., for more equitable longer-term planning, impact assessment, and risk mitigation. NASA could help provide usable data for relevant stakeholders, prepare them to use data more effectively, and improve the utility and accessibility of the data. Another suggestion was for NASA to consider areas where there are gaps in the data that EJ communities need and to figure out ways for EO data to fill those needs (e.g., health). NASA should also clarify priority time frames for accessing and integrating data, e.g., on short, medium, and long term frames, in relationship to different EJ issues (e.g., disasters, resource access, climate change) and identify needs and gaps in data on those time frames. NASA could try to design more flexible tools and interfaces to reach diverse audiences, plugging into existing frameworks and standards that communities already use and tailoring the level of detail and information to the level of expertise and specific concerns of the target audience. For EJ researchers and social scientists, NASA could do more to make data analysis-ready, e.g., providing data in formats commonly used by social science analysis software such as R, STATA, and SPSS.

Summary by Topic and Room

Session 1, Room 1: Human Health

Responses to the Session 1 questions by participants focused on categories 2 and 3 above. Participants were particularly interested in higher spatial resolution data at a neighborhood level. One participant identified a need for “data to help identify 1) vulnerable communities and 2) vulnerable individuals within communities, which can be harder to identify because some community members have resources to avoid the negative health outcomes of environmental factors.”

Several participants mentioned that human health topics require a certain level of sensitivity that other topics may not. In addition to addressing vulnerable populations, considerations related to the mental and physical health of communities also need to be addressed. Participants also highlighted the need to empower vulnerable communities to be able to use the data available to them. One participant said, “[There is a need] for persons to have a voice in the questions that are raised and addressed through the use of the data. Also, for affected groups to provide context about results and how those results are disseminated.” Another commented, “[There is

a need] to empower community members to have access to data to understand and measure progress related to emerging concerns.”

Session 1, Room 2: Climate, Adaptation, and Resilience

The participants for the Climate, Adaptation, and Resilience room focused on all categories of responses, highlighting the need for awareness of NASA data, its increased accessibility, and a need for higher resolution data. This group highlighted several examples of ways EO data can be used to better communicate and monitor risks to vulnerable populations. Suggestions from participants included:

- “Translate flood model results into a 3-D model that shows the impact. Also a way to show the trade offs in planning decisions and the impacts on outcomes for community”
- “Injustices have been institutionalized over centuries as cities and financial institutions have been developed. Similar to obtaining trends in changing ecosystems over time, we should use EO to understand the historic marginalization of communities and the way this has played out via air quality, limited access to food systems, poor health due to Locally Unwanted Land Use (LULUs), etc. This could ideally be extended to improving future scenarios. This requires a system perspective.”
- “People have asked whether ‘if we remove a highway or undo a particular decision that marginalized a community - would this undo the injustices?’ Being able to assess the changes/impacts between simply undoing what was done versus how to change what can be done moving forward would be incredibly valuable. This could be aligned with assessing or evaluating the impact of a particular positive policy decision.”
- “LMI [*low and moderate income*] communities living in flood-prone areas have fewer options to leave or to make systems resilient; NASA data could help track development within a floodplain over x-years; create/share user-friendly climate data history and projections”

Several comments reflected on the need to make NASA data more accessible to a larger variety of communities. One participant commented that there was a need to “address challenge[s] about accessibility and usability of our knowledge for all, not just for the elites. Think about how to democratize the entire data enterprise. Focus on accessibility and usability for all, become the people’s agency.”

Another topic that came up in the discussion was the need for higher spatial resolution - particularly the ability to use EO data to identify actors responsible for environmental impacts, e.g., facilities responsible for bad air quality. Others identified a need for higher resolution flood modeling and impacts on a neighborhood-level.

Session 1, Room 3: Disasters

In the needs and priorities session room focused on disasters, participants acknowledged the inherent difficulty in using EO data for disasters, e.g., in knowing when a disaster is happening or how the disaster will impact distribution of supplies afterward. Participants recognized that NASA data can be used in monitoring disasters and provide information that could aid disaster relief and response efforts, especially for disadvantaged, hard-to-reach, or highly vulnerable communities. In addition, participants agreed on the need to engage community members in the process/discussion of disasters planning and mitigation at early stages.

Participants also highlighted the need for more accessible data and accompanying capacity building to use it: “It would be helpful to enable and unleash the power of vulnerable and underserved communities to collect, analyze, and manage *in situ* data post disaster (e.g., impacted water quality after a hurricane). This includes pre-disaster training, capacity building, providing access to resources and expertise, guidance on how to use low cost sensors, on how to ensure good quality data collection, etc. See for example the work of the EPA for their Citizen Science efforts.”

Participants encouraged NASA to listen to communities and “ensure the problem you’re trying to solve is one that is put forward by the communities themselves, not by NASA or others.” They also highlighted the need to recognize historical policies and institutionalized difficulties experienced by marginalized communities. One participant noted: “We need to have difficult conversations and understand the institutional policies that have gotten us to this situation, like colonization and racism.”

Session 2, Room 1: Data

For the data-focused session on solutions and opportunities, participants had specific feedback for all questions asked. When asked what data would most impact and improve equity and environmental justice, several participants indicated that scalable, higher-resolution data would be key in increasing the impact of the data. Going from the neighborhood scale to city and state level data would better inform policy decisions at different levels. One participant noted that it would be useful to have the “ability to zoom in and see the physical characteristics of the places where people live their lives. Are there sidewalks? Can a wheelchair user use a ramp to cross the street?”

In response to being asked what sector could best use geospatial data, the answers generally concluded that most sectors could. Federal, state, and local governments were called out, as well as academia and nonprofit organizations. One participant wrote, “all sectors need to work together.”

When asked what social science datasets would benefit their work, participants responded that more granular population data (e.g., income, race/ethnicity, language, transportation

access/type, and population movement) would be desirable. Participants recognized that internationally more reliable population data used in conjunction with EO data would help better identify vulnerabilities in communities.

Session 2, Room 2: Research

The room dedicated to research had only one non-NASA participant. The participant, a university researcher, mentioned some pros and cons of NASA data. They considered the global availability of data as a pro, and owing to their remote sensing analysis and technical skills they did not have many barriers to access for NASA data. As cons, they mentioned that many EJ communities do face barriers to access. They also highlighted a need for policymakers to have higher resolution data and a need to identify specific causes of environmental harm; but they recognized that NASA data alone may not be capable of doing this (e.g., of tracing emissions back to a particular source).

Another topic within academia the participant raised is that developing relationships with vulnerable communities requires time and effort. The university where they work has local “practitioners in residence” who are individuals knowledgeable about and involved in the community and serve as a liaison with the research teams. The practitioner has a one-year appointment. The practitioner is treated as the subject matter expert, presents a problem, and researchers are able to provide them with university resources and datasets that meet their needs. Rather than the researchers being the lead on the project, the practitioner leads and the researchers provide support.

Challenges include finding long-term funding for those involved given the short-term nature of grant cycles. There is also the common issue of the lack of reward and incentive structures in academia, which tend not to encourage community-based work or to weigh it very highly during tenure review.

The participant in this session also challenged NASA to ask an additional question of communities as it continues its listening: “What new questions could you ask with geospatial data?”

Session 2, Room 3: Applications

For the applications-focused session on solutions and opportunities, participants highlighted the need for historical and time series information. Ideal applications involve tools that give access to as much data as possible. Applications experts can engage with as many sectors as possible, and these engagements need to be relevant to each sector. In addition, more virtual tools that can communicate data more effectively and data access, especially for historically marginalized communities. One participant suggested the development of a tool that could provide a virtual data environment or community explorer with physical and ecological

parameters. Building off this point, several comments focused on the accessibility of data and the need to build capacity for using NASA data. One participant noted: “Target people living in the communities. So everyone can see the evidence or lack of evidence for exposure to hazards. About providing transparency and exploring historical [biases].”

Feedback also mentioned the need to understand communities prior to offering solutions. Participants emphasized the need for the partnership between social science research and Earth observations: “What people’s decisions are driving the biophysical changes that we are observing? What’s motivating their actions? Need process level understanding of human behavior and how [it] impacts the planet. Merge top down and bottom up.”

Workshop Follow-Up

NASA ESD appreciates the feedback from the participants in the workshop. This summary has been prepared by the organizing team based on the breakout sessions and discussions. All participants may not necessarily agree with every comment and suggestion included. The report is intended to be one input into future NASA ESD activities and plans, along with other inputs and considerations. Specific suggestions or inputs discussed at the workshop may not be reflected in NASA’s future EJ plans and activities. This report is being provided to the participants and posted publicly on the NASA ESD website.

Appendix A: Workshop Participants

Invited Participants

Julius Adewopo, Mercy Corps

Susan Anenberg, George Washington University

Nita Bharti, Pennsylvania State University

Hannah Druckenmiller, Resources for the Future

Jeanne Holm, City of Los Angeles

Gaige Kerr, George Washington University

Amy Pienta, University of Michigan

Ben Preston, Rand Corporation

Sally Pusede, University of Virginia

Barbara Ryan, World Geospatial Industry Council

Lea Shanley, International Computer Science Institute

Margaret Walls, Resources for the Future
Linnea Warren May, Rand Corporation
Brian Watts, The Pew Charitable Trusts
Sarah Williams, Massachusetts Institute of Technology

NASA Earth Science Division Participants

Lauren Childs-Gleason, ESD-Applied Sciences
Steven Crawford, ESD-Data
Brad Doorn, ESD-Applied Sciences
Lawrence Friedl, ESD-Applied Sciences
Gerald Guala, ESD-Data
Shobhana Gupta, ESD-Applied Sciences
Cynthia Hall, ESD-Data
Yvonne Ivey, ESD-Data
Argie Kavvada, ESD-Applied Sciences
Drew Kittel, Goddard Space Flight Center
Barry Lefer, ESD-Research & Analysis
Allison Leidner, ESD-Research & Analysis
Francis Lindsay, Goddard Space Flight Center
Shanna McClain, ESD-Applied Sciences
Ben Phillips, ESD-Research & Analysis
Elena Steponaitis, ESD-Data
Karen St. Germain, ESD
Krishna Vadrevu, ESD-Research & Analysis
Amanda Whitehurst, ESD-Flight

Organizing Team

Susana Adamo, SEDAC/Columbia University
Robert Chen, SEDAC/Columbia University
Alex de Sherbinin, SEDAC/Columbia University

Elizabeth Hook-Rogers, ESD-Research & Analysis

Yáitza Luna-Cruz, ESD-Data

Aaron Piña, ESD-Research & Analysis

Nancy Searby, ESD-Applied Sciences

Appendix B: Workshop Agenda

Time (ET)	Agenda	Description
2:00 - 2:10 PM	Welcoming Remarks & Introductions	<ul style="list-style-type: none">● Moderator (5 min): Yáitza Luna-Cruz● Remarks (5 min): Karen St. Germain
2:10 - 2:20 PM	Overview of NASA Equity and Environmental Justice Activities (10 min)	<ul style="list-style-type: none">● Aaron Piña
2:20 - 2:50 PM	Session 1: Needs & Priorities (30 min) (Guided questions - digital interactive whiteboard) Room #1: Human Health Room #2: Climate, Adaptation & Resilience Room #3: Disasters	<ul style="list-style-type: none">● Moderator: Yáitza Luna-Cruz<ul style="list-style-type: none">○ R1: Alex de Sherbinin, Aaron Piña○ R2: Bob Chen, Nancy Searby○ R3: Susana Adamo, Yáitza Luna-Cruz
2:50 - 3:00 PM	Plenary: Key takeaways (10 min)	<ul style="list-style-type: none">● Aaron, Nancy, Yáitza
3:00 - 3:10 PM	<i>10 min Brain & Health Break</i>	
3:10 - 3:40 PM	Session 2: Solutions & Opportunities (30 min) (Guided questions - digital interactive whiteboard) Room #1: Data Room #2: Research Room #3: Applications	<ul style="list-style-type: none">● Moderators: Yáitza Luna-Cruz<ul style="list-style-type: none">○ R1: Yáitza Luna-Cruz, Bob Chen○ R2: Aaron Piña, Alex de Sherbinin○ R3: Nancy Searby, Susana Adamo
3:40 - 3:50 PM	Plenary: Key takeaways (10 min)	<ul style="list-style-type: none">● Bob, Alex, Susana
3:50 - 4:25 PM	Open Discussion and Recommendations (35 min)	<ul style="list-style-type: none">● Moderator: Nancy Searby
4:25 - 4:30 PM	Closing remarks	<ul style="list-style-type: none">● Moderator: Yáitza Luna-Cruz