



**NATIONAL
WEATHER
SERVICE**

IMPROVING SERVICE TO OUR COMMUNITIES: NWS EDUCATION AND OUTREACH ACTIVITIES

**Social, Behavioral, and Economic
Sciences Program**

**NWS Office of Science &
Technology Integration**

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Cover Images (Image Credit - NOAA NWS)

NWS Meteorologist provide students with career information and how to become a meteorologists

Open House at the National Centers for Environmental Prediction, College Park, MD

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Introduction

Thousands of times each year, the National Weather Service (NWS) engages in public outreach and education events that reflect its commitment to ensure that “every citizen is equitably receiving and responding to the vital forecast information that we provide¹.” This NWS goal aligns with the January 2021 Presidential Executive Order that calls for a “comprehensive approach to advancing equity for all, including people of color and others who have been historically underserved, marginalized, and adversely affected by persistent poverty and inequality².”

This report describes the current state of actions being taken by the NWS to achieve this goal, working to better understand the communities they serve and allocate resources to enhance services for them. Data were obtained through a screener survey and semi-structured interviews with NWS staff members in its Weather Forecast Offices (WFOs), Regional Offices, National Centers for Environmental Prediction (NCEP), and River Forecast Centers (RFCs). The screener survey either qualified or disqualified the respondents from the semi-structured interviews, identifying those offices that had community activities and were willing to share their experiences. Of the 142 offices in the sample, 57 responded to the survey and 35 agreed to participate in a follow-on interview to discuss measures they’ve implemented to better serve their communities. Ultimately, 32³ interviews were conducted yielding over 500 pages of transcripts from which 1,600 excerpts were selected for analysis, the results of which are presented in this report. Of the 32 interview participants, 31 were Warning Coordination Meteorologists or other staff members from WFOs; the remaining interview was

“I think what you're doing [this study] is really important. This whole effort is a pivot, if you will, of our agency towards being more intentional in engaging with vulnerable populations. I think it's very important. It's appropriate. There's no blueprint of exactly how you go and do that. But I think efforts like this are going to help, especially in sharing best practices. ‘Oh, this office is doing this, this office is doing that. Oh, that's very helpful.’”

Respondent from Southern Region

“I think we talked about the last time, that you're making your report and if you're making the report for the field can you also make sure the report also goes up the chain, realizing that this is useful, but [outreach to socially vulnerable communities] takes a lot of time and energy and resources.”

Respondent from Alaska Region

¹ National Weather Service. 2022. 2023-2033 Strategic Plan. Accessed on July 26, 2023 at <https://www.weather.gov/media/wrn/NWS-2023-Strategic-Plan.pdf>. Estimate of outreach events from NOEES data where more than 60,000 events are recorded over the five years between 2017 and 2021.

² United States, Executive Office of the President [Joseph R. Biden]. Executive order 13985: Advancing Racial Equity and Support for Underserved Communities Through the Federal Government. 20 January 2021.

³ The team was unable to conduct 2 of the 35 interviews because of scheduling conflicts. Records of another interview were derived entirely from notes that lacked sufficient detail for their use in the analysis.

conducted with two staff members from one RFC. To preserve the anonymity of interview respondents, this report limits the use of terms and descriptions that could be used to identify a specific individual⁴.

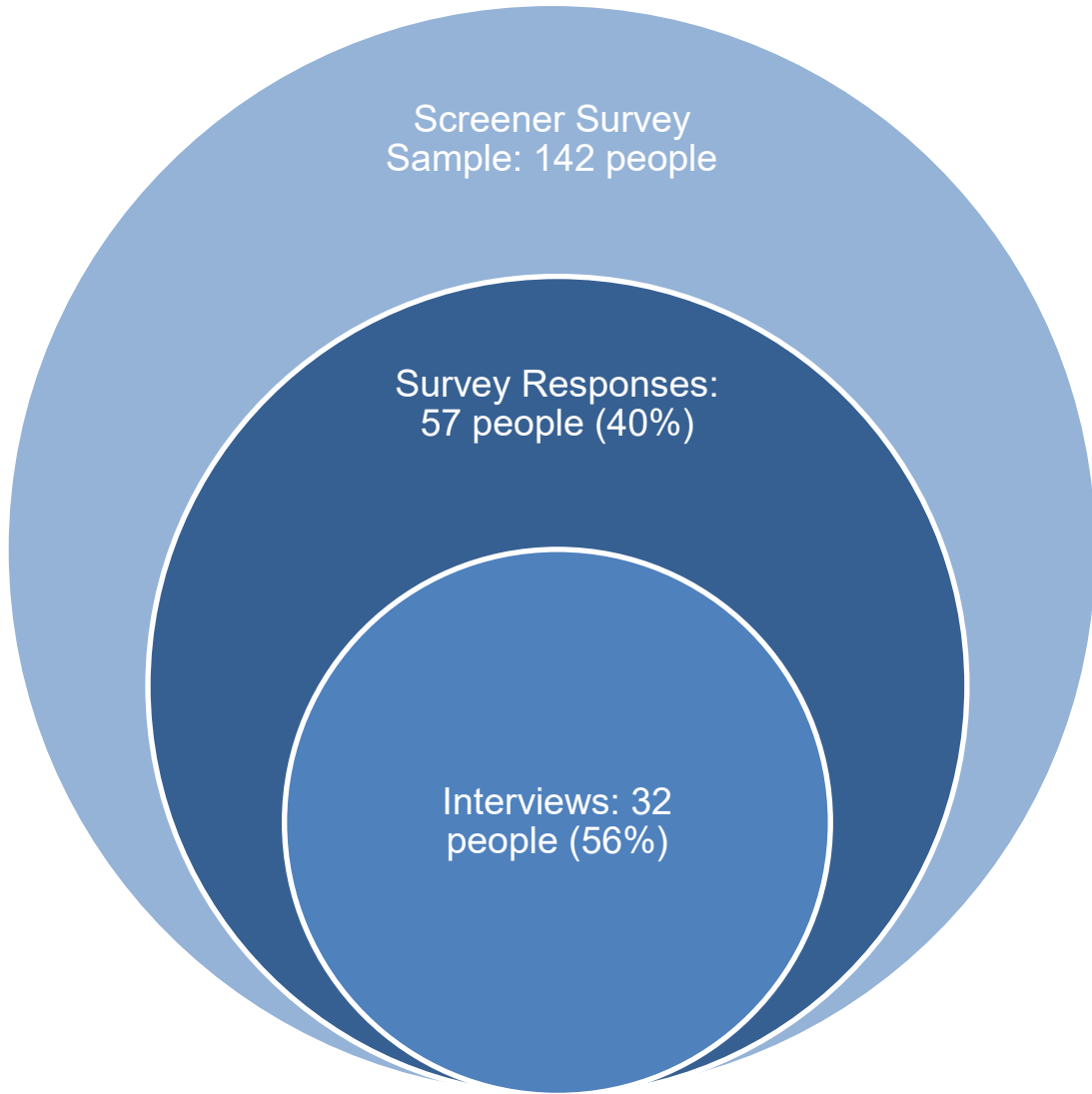


Figure 1: Summary of Responses to Surveys and Interviews.

⁴ Quotations in call-out boxes identify respondents by the NWS Region in which their office is located. These references are not meant to imply that the respondent worked in a Regional Office.

What is Social Vulnerability?

The concept of social vulnerability is central to this analysis and for this report, where it is defined as the heightened susceptibility of specific social groups to harm from hazards, encompassing "disproportionate death, injury, loss, or disruption of livelihood⁵." Although there is "no consensus" and "diverse views regarding the precise meaning of vulnerability,"^{6,7,8,9,10} for purposes of this study, the Federal Emergency Management Administration (FEMA) definition of social vulnerability seemed most relevant and reasonable to use.

Many of the communities that are commonly identified as socially vulnerable, such as the indigenous peoples of North America, may not consider themselves to be more vulnerable than others. Published data on social vulnerability fall into a few major classes indicating persons who are:

"My whole job is very difficult to measure anyway, because how do you know how many people weren't killed because you told them something?"

Respondent from Central Region

- Less likely to receive hazard information through commonly used dissemination networks (e.g., communities with low English proficiency).
- Less able to respond appropriately to hazard information (e.g., those with no access to automobiles and individuals with disabilities).
- More likely to be harmed by hazards (e.g., those living in substandard housing or mobile homes).
- Less able to take protective actions (e.g., low-income families).

⁵ Federal Emergency Management Administration. Undated. Social Vulnerability. Available at <https://hazards.fema.gov/nri/social-vulnerability>. Accessed July 31, 2023.

⁶ Gallopín, G.C., 2006. Linkages between vulnerability, resilience, and adaptive capacity. *Global environmental change*, 16(3), pp.293-303.

⁷ Fekete, A., 2019. Social vulnerability (re-) assessment in context to natural hazards: Review of the usefulness of the spatial indicator approach and investigations of validation demands. *International Journal of Disaster Risk Science*, 10, pp.220-232.

⁸ Barry, V., Dasgupta, S., Weller, D.L., Kriss, J.L., Cadwell, B.L., Rose, C., Pingali, C., Musial, T., Sharpe, J.D., Flores, S.A. and Greenlund, K.J., 2021. Patterns in COVID-19 vaccination coverage, by social vulnerability and urbanicity—United States, December 14, 2020–May 1, 2021. *Morbidity and Mortality Weekly Report*, 70(22), p.818. Social vulnerability is defined as the "social and structural factors associated with adverse [outcomes]"

⁹ Palaiologou, P., Ager, A.A., Nielsen-Pincus, M., Evers, C.R. and Day, M.A., 2019. Social vulnerability to large wildfires in the western USA. *Landscape and urban planning*, 189, pp.99-116. This definition cites older work by Blaikie et al., 2004, Cutter and Finch, 2009, defining social vulnerability as "the adaptive capacity to absorb, recover and modify exposure to [natural hazards]."

¹⁰ Spielman, S.E., Tuccillo, J., Folch, D.C., Schweikert, A., Davies, R., Wood, N. and Tate, E., 2020. Evaluating social vulnerability indicators: criteria and their application to the Social Vulnerability Index. *Natural Hazards*, 100(1), pp.417-436. Social vulnerability defined as the "social, cultural, economic, political, and institutional processes that shape socioeconomic differentials in the experience of and recovery from hazards."

Several indices are currently available that provide indicators of social vulnerability. While these empirically-based indices are useful, they augment but do not replace the local knowledge of the NWS and its partners.

This study assessed the utility of nine such indices, each commonly used but distinct in its approach and focus. Some indices focus exclusively on social vulnerability, while others incorporate additional factors like the condition of water/wastewater infrastructure, exposure to natural hazards or the effects of climate change, or legacy pollution. The differences in these indices reflect differences in their intended use, making some indices more suitable for a specific use than others.

We used the following criteria to identify the best index for identifying and improving service to the socially vulnerable communities that NWS serves:

- Data are primarily or exclusively focused on social vulnerability without considering other factors that also affect the index.
- Data are available at sub-county scales. This is important because social vulnerability often varies significantly within counties.
- Data are regularly and frequently updated to reflect the effects of migration and other population dynamics.
- Full dataset is downloadable, allowing users to perform customized analyses.
- Data are reported for components of the overall vulnerability scores, allowing users to identify the specific factors that account for vulnerability in an area. Such information is actionable because, for example, the actions needed to address the needs of Spanish-speaking communities differs from those needed to meet the needs of the deaf and hard of hearing.

Of the nine indices that were evaluated, only the Center for Disease Control and Prevention's Social Vulnerability Index (SVI) met all of these criteria. Updated every two years¹¹, the SVI gives a snapshot of the vulnerability "of every U.S. Census tract¹²," sub-county units that "generally have a population of between 1,200 and 8,000 persons with an optimum size of 4,000¹³." This data provides scores ranging from 0 to 1, for sixteen indicators of social vulnerability grouped into four major categories as shown in the figure below.

¹¹ Center for Disease Control and Prevention. Undated. CDC/ATSDR SVI Frequently Asked Questions. Available at https://www.atsdr.cdc.gov/placeandhealth/svi/faq_svi.html. Accessed on September 6, 2023.

¹² Center for Disease Control and Prevention. 2022. CDC SVI Documentation 2020. Available at https://www.atsdr.cdc.gov/placeandhealth/svi/documentation/SVI_documentation_2020.html. Accessed on September 6, 2023.

¹³ U.S. Census Bureau. Undated. Glossary of Geographic Terms. Available at <https://www.census.gov/programs-surveys/geography/about/glossary.html>. Accessed on September 6, 2023.

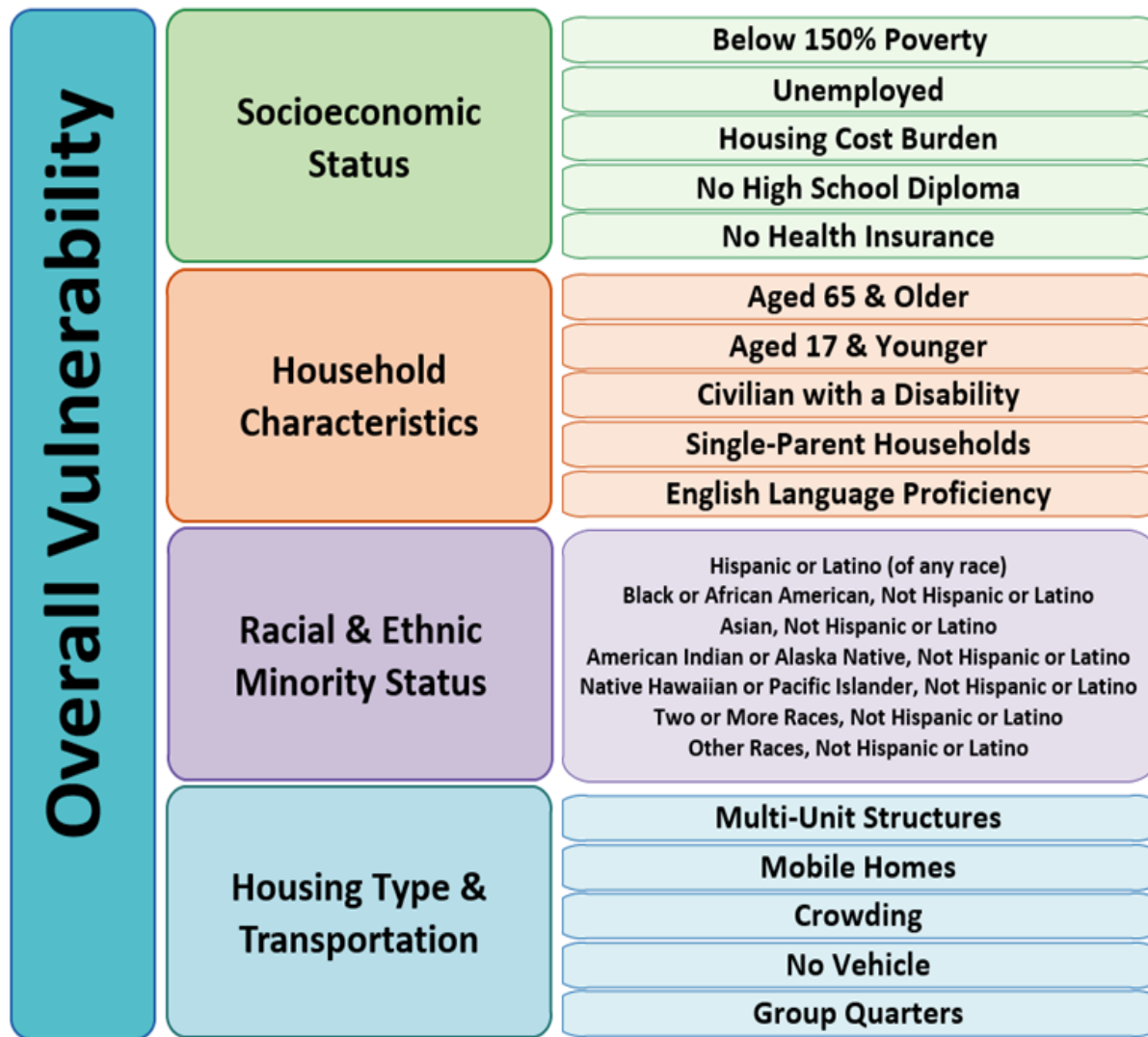


Figure 2: Major Themes and Sub-Factors in the CDC's Social Vulnerability Index¹⁴.

¹⁴ Center for Disease Control and Prevention. 2022. CDC SVI Documentation 2020. Available at https://www.atsdr.cdc.gov/placeandhealth/svi/documentation/SVI_documentation_2020.html. Accessed on September 6, 2023.

Methods

The NWS Social, Behavioral, and Economic Sciences (SBES) Program fielded a screening survey and then conducted semi-structured interviews¹⁵ to collect information for this study. Responses to the survey (see Appendix A) identified offices that implemented actions to improve service to communities identified as vulnerable. The survey also identified those willing to participate in an interview to provide additional details on vulnerabilities within their service areas and the actions that they have implemented to address those vulnerabilities. The survey also solicited input on the frequency with which WFOs entered data into the NWS Outreach and Education Event System (NOEES).

The semi-structured interview protocol (see Appendix B) focused on four main topic areas:

- Assessment of social vulnerability by NWS offices,
- Actions undertaken by the office to improve services to vulnerable communities,
- Implementation Challenges, and
- Outcomes.

The interviews also included questions on the usability and utility of NOEES to better understand responses to the survey that indicated a lower degree of NOEES use than was expected. Anonymized transcripts were coded using Dedoose¹⁶, a cloud-based qualitative analysis software, to generate content for this report.

NWS Assessments of Social Vulnerability

Indicators of Vulnerability Noted in NWS Staff Interviews

During the interviews, several SVI factors were commonly named by NWS staff as indicators of vulnerability¹⁷; some were rarely mentioned such as living in group quarters, housing cost burden, and single parent households; and several groups not reflected in the SVI were identified as particularly

Several SVI factors were commonly named as indicators of vulnerability, some were rarely mentioned, and several socioeconomic factors not included in the SVI were named as important indicators of vulnerability.

¹⁵ A structured interview is a method that relies on asking questions in a set pre-determined order with no deviations in order of question or the type of question asked. While semi-structure interviews have some pre-determined questions and some order, but the interviewer is allowed to probe and ask questions based on the responses given. Its more exploratory in nature than a structured interview. See, for example, Mueller, A.E. and Segal, D.L., 2014. Structured versus semi-structured versus unstructured interviews. *The encyclopedia of clinical psychology*, pp.1-7.

¹⁶ For more information, see <https://www.dedoose.com/>.

¹⁷ As noted above, the presence of one or more of the factors included in the SVI does not necessarily mean that a community is more vulnerable to harm than others. In some cases, as with indigenous people living in harsh environments, the SVI could indicate vulnerability in communities whose resilience has been demonstrated over many generations.

vulnerable such as rural populations, tourists and others unfamiliar with the area, as well as those experiencing homelessness.

NWS staff identified poverty as a primary issue that was linked to numerous other aspects of social vulnerability. As one respondent put it, “the base poverty issue, more so than anything, carries over into [other] things...” Interview respondents noted that poverty isn’t an isolated economic condition but was intertwined with other challenges like low English proficiency, unemployment, the lack of health insurance, living in mobile homes, limited access to health care, homelessness, lack of adequate heating and cooling, living in locations that are vulnerable to flooding and landslides, distrust of the government, limited access to communication systems, and other factors that increase the vulnerability of a community to harm from weather hazards. They also described the impacts of poverty on Native American, Alaska native, racial minority, and many urban and rural communities. Although respondents provided multiple examples where social vulnerability was not linked to poverty¹⁸, they commonly identified poverty as a primary source of vulnerability, increasing the harm to communities from weather hazards and reducing their ability to receive and effectively respond to weather information. Interview respondents stated that the vulnerabilities within communities intensified when multiple factors were present. For example, wealthy communities of older adults were considered less at risk compared to their less affluent counterparts. Several people noted that vulnerabilities often overlap, with a combination of factors like age, race, socioeconomic status, and access to technology working together to increase a community's vulnerabilities to natural hazards.

Only 4 of the 32 interview respondents stated that they use the SVI to gain a better understanding of their vulnerable communities, and none of them indicated that they rely exclusively or even primarily on the SVI. It was not enough, they said, to be aware that a social vulnerability exists. Local partnerships were deemed crucial to truly grasp a community's needs and to identify contacts through which these communities can be reached. Respondents identified a number of local

“One thing we've noticed in [island jurisdictions] is that there's a lot of people that are intermixed as far as socioeconomic status. There's not a rich section and a poor section, it's kind of spread out. And I am not sure if the census tracts that are used for the SVI capture that scale that we need.”

Respondent from Pacific Region

“[One tribal community] got 40 inches of snow. So over three feet of snow, ... a rural setting, ... a dispersed population. So not only are these roads dirt, but the driveway, if you will, to a house that is about three miles long... So, if you can imagine three feet of snow on a three-mile-long driveway with dirt underneath it. That takes a long time to get food... like again, no infrastructure. So, the way that folks have heating out there—it's wood, you know, fires, ...no electricity, ...the water supply was low.”

Respondent from Western Region

¹⁸ For example, one staff member described the low English proficiency of a large, relatively affluent Arabic-speaking community.

partners that have been helpful in identifying vulnerable communities including:

- emergency managers (often cited as the primary source of this information)
- organizations providing shelter and food
- warming and cooling shelters
- public health agencies and non-governmental organizations (NGO)
- the Latino Chamber of Commerce
- Native American and Alaska Native tribal leaders
- county governments
- LGBTQ+ organizations
- Arabic community organizations
- refugee resettlement agencies
- agencies and NGOs supporting at-risk youth

The figure below provides a summary of responses to questions about the most important social indicators of vulnerability present in the participant’s CWAs.

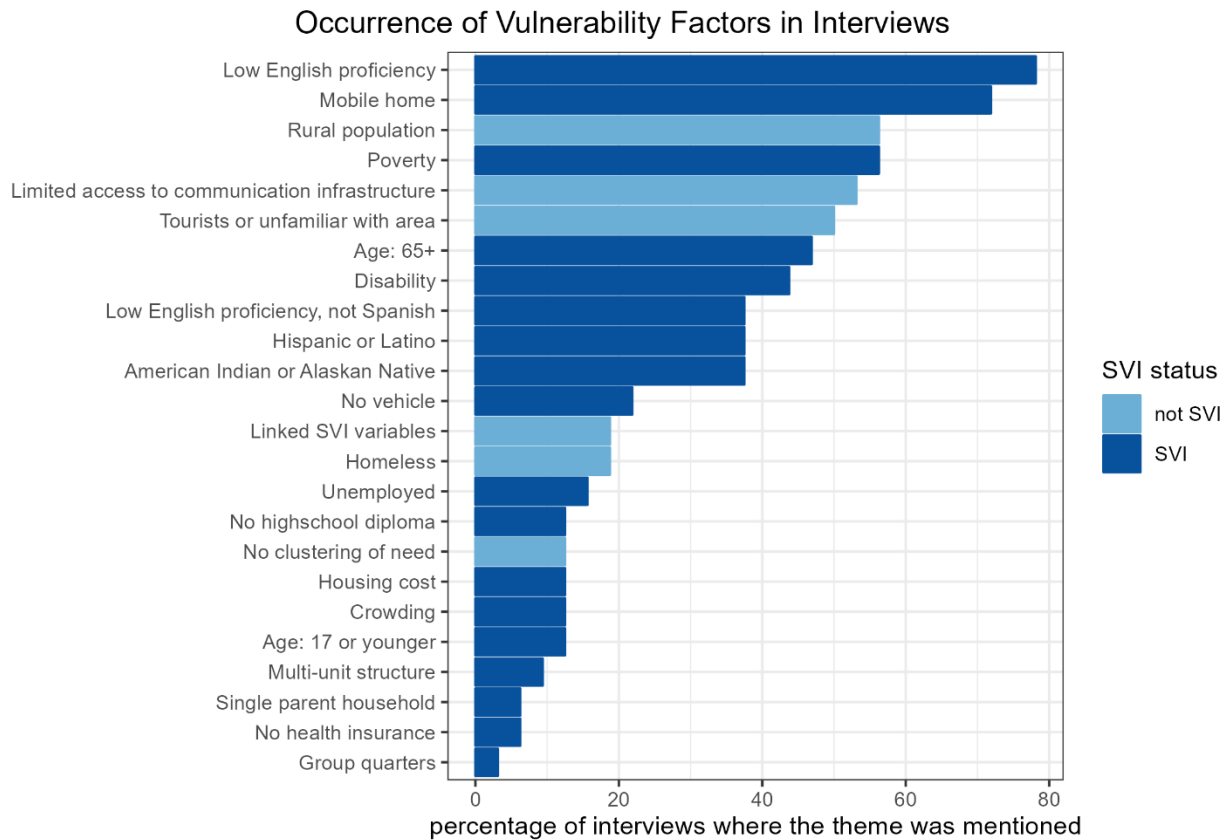


Figure 3. Percentage of Interviews Where the Vulnerability Factor was Mentioned.

Overall, these interviews revealed a complex web of social vulnerabilities that intersect and interact in various ways. They demonstrated how different social factors created unique challenges for people in preparing for, responding to, and remaining safe during weather-related

emergencies. The responses also showed that, although the SVI was a useful tool, it did not

vulnerable communities. For this reason, the SVI was viewed as a useful complement to other information sources, the most important being the insights gained through well-established relationships of trust.

Actions Taken to Improve Service to Vulnerable Communities

During the interviews, three major themes emerged on actions that have been taken to improve service to vulnerable communities:

1. The Need for New Partnerships,
2. Improving Access to NWS Information, and
3. The Vital Importance of Core Partners.

These three themes are explored in the sections below.

The final section of this report summarizes the comments on the NWS Outreach and Education Event System (NOEES). Most respondents voiced strong dissatisfaction with NOEES, characterizing it as being inefficient, outdated, and hard to use.

“When I started in this job, I would have from the first day I got here made an effort to shake hands with every single one of the stakeholders I could, real early on. Because you're overwhelmed when you start in a new job and you feel like you need to shake hands with the ones you think are the most important first, the “big people,” right? And that makes the disadvantaged communities feel even more disadvantaged. And you spend years digging yourself out of that.”

Respondent from Eastern Region

Theme 1: The Need for New Partnerships

Despite the vital importance of strong relationships with traditional core partners, respondents reported that vulnerable communities can sometimes “slip through the cracks.” To address this concern, many WFOs have expanded the scope of their partnerships, sometimes using the term “new partners” to refer to organizations who have a deep understanding of specific communities and already forged strong relationships with them. In this report, we refer to such organizations as “community partners.” Relationships with community partners have been the product of grassroots efforts by individual NWS field offices rather than through structured and coordinated campaigns. Responses show a high degree of variability among WFOs in the types of organizations that are being engaged as community partners, with the variability reflecting local circumstances. Examples range from faith-based organizations and senior citizen centers to national consulates.

During interviews, respondents described various activities that allowed them to leverage the skills, networks, and programs of community partners. Several respondents described collaboration with public health agencies to develop a more localized understanding of vulnerabilities, refine heat and cold advisories for the unhoused, and ensure that messages about extreme temperatures reached those whose medications impaired their ability to regulate their body temperature. Others reported leveraging the communication networks of local housing authorities to promote hurricane preparedness and deliver targeted messages on flooding and excessive temperatures to those living in substandard housing.

Respondents also reported the benefits of leveraging the networks of faith-based organizations and other non-governmental organizations to expand the reach and impact of NWS products and services within the communities served by these organizations. These community partnerships include national organizations like the National Association for the Advancement of Colored People (NAACP) and local organizations like La Familia in Pontiac, Michigan, whose primary mission is to provide culturally-competent support services to families of Latinx descent. The table below shows some of the community partners identified in the interviews.

Examples of Community partners		
Public Health Agencies	Medical Facilities and Coalitions	Social Service Agencies
School Superintendents	Housing Authorities	Law Enforcement Agencies
Fire Departments	Emergency Medical Responders	NGOs (serving, for example, adults with special needs, HIV patients, deaf and hard of hearing, the homeless, and recent immigrants)
Senior Citizen's Centers	Nursing Homes	Home Medical Equipment Providers
Faith-Based Organizations	Homeless Authorities	University-Based Public Health Researchers
Coroner (information on heat and cold fatalities)	Agriculture Extension Cooperatives	Rural Development Agencies
Mobile Home Parks	Pharmacies (dissemination of materials)	Court Houses (dissemination of materials)
Natural Resource Agencies	Parks	Advocacy Programs (e.g., NAACP, La Familia, and AARP)
Chambers of Commerce	Professional Sports Teams (outreach to inner city communities)	Other Voluntary Organizations Active in Disaster (VOADs)

Respondents overwhelmingly cited staffing limitations as a key constraint in fulfilling their outreach and education missions. Even when fully staffed, they reported finding it difficult to address these responsibilities due to shift work, the competing demands of their jobs, and scheduling conflicts. For example, one respondent observed that employees on midnight shifts cannot participate in outreach events, which typically occur in the evening or during business hours. Another respondent stated that the NWS staffing model is outdated, reflecting the conditions and demands of the 1990s and not meeting present-day needs, which includes outreach activities. Compounding the issue, many offices reported that they were not fully staffed; one participant stated that their WFO had not been fully staffed for eight years. They also stated that the prevailing weather conditions affect staff availability, especially in parts of the country where severe weather frequently leads to cancellations of outreach activities, which damages trust and the NWS' reputation for reliability. Several respondents pointed to the characteristics of county warning areas as another complicating factor, with some covering large geographic areas, others representing dozens of county and tribal jurisdictions, and one serving a diverse population exceeding 10 million people. In response to such challenges, one participant cited the need for training of additional staff who were not serving in a WCM role to increase the pool of people available for outreach and education. Another deputized associate WCMs to handle outreach in some parts of the service area.

NWS staff described their most effective partnerships as relationships based on trust and the willingness to listen. The importance of listening was noted by numerous respondents. One staff member observed that "...we think we have the answers and we want to sell our services, which is good to do, but I think the first thing you have to do is stop and listen to what people need, rather than just trying to force what we have." Another interview participant said, "...don't just be a government bureaucrat; go there and listen..." Building trust, they noted, was vital. "You can't just show up somewhere and say, Hey, I'm here to help. You know, they don't believe you, because you weren't there before they needed help." Building trust isn't a quick process, as interviewees acknowledged; it requires sustained time and commitment. One respondent said that "...you just have to build [trust] over time, you can't do it overnight." Investing the time and resources that are needed to establish trust is a stark contrast to what another respondent characterized as "drive-by" outreach, "where you stop once and then you're gone. ...it's not going to be effective."

"I just gave general hurricane information and then afterwards, we opened up the booths for everybody and we got to mingle, the crowd got to mingle with us, and we had all this great engagement and then someone I was talking to, I can't remember her name, but she came up and we were talking and I said, I'm so glad that you're here. I really appreciate you taking the time to come learn more about hurricanes. And she stopped me in my tracks. She says, "We're just so glad you are here. Pastor Nixon said that this was going on, and he said that we needed to be here, and we're here." And that really just opened my eyes to how important that leadership connection was to galvanizing a congregation or community."

Respondent from Eastern Region

The importance of trust and the willingness to listen was illustrated in responses describing NWS relationships with Native American and Alaska Native governments and with the emergency managers (EMs). Although these tribal EMs are core partners, most respondents described tribal partnerships as budding. Twelve respondents out of the 32 interviewed discussed the importance of their partnerships with Native American and Alaska Native communities, but only three described their interaction as equal to those with other core partners. Often, initial interactions with tribes were facilitated by local U.S. government EMs with established relationships with tribal EMs and tribal governments. Several respondents noted the importance of fostering and sustaining relationships of trust with tribal officials before relaying critical weather information. Developing such relationships, they noted, required time and regular communications.

NWS staff described a variety of actions taken to build and maintain their relationships with tribal communities. One respondent reported their work with tribal partners to create charts showing different types of clouds, labeled in the tribal language. Another respondent described their collaboration with a radio station operated by a Native American tribe to set up weather observation sites to improve the accuracy of local weather data and forecasts. One respondent described their interaction with an intertribal organization to provide support to multiple tribal communities. However, another respondent noted the strong independence of the tribal communities they serve, requiring a more personalized approach with each tribal community in their part of the country.

“Because that is at least a little bit different [with Native American communities]. So first of all, there's no language barrier. In fact, it's quite the opposite. Their culture has been... Well, in the past, the federal government was trying to eliminate their culture and assimilate them, so that one of the big things was not letting the kids speak their native tongue. They're trying to revive that through working with elders to teach the younger people how to speak.”

Respondent from Central Region

Several respondents stated that, through their relationships with community partners, they learned of and have worked to overcome the distrust of the government that exists in some communities. While not universally pervasive, interview responses indicate that distrust of the government was present in many communities, which hindered NWS outreach and education efforts. Examples of such communities provided in interview responses include Native American and Alaska Native communities, racial minority groups, rural and poor communities, and those with low English proficiency. According to interview responses, WFOs have leveraged the established trust that community partners hold in these communities, primarily because of their direct service to them. As one interview respondent put it, “So, you know, you gotta find somebody that they trust.” In addition, some respondents stated that they appointed designated representatives to consistently engage with specific communities to foster familiarity and trust.

“...some of our vulnerable populations do have a distrust of the federal government in particular so ... our goal would then be to partner with local partners or the people they are already familiar with.”

Respondent from Eastern Region

Collaboration with community partners, as reported by interview participants, showed a pattern of starting small and building on initial successes. One WFO assisted a local health department in refining their heat-related guidance, aligning the guidance with the NWS HeatRisk forecast system. This collaboration allowed more consistent heat warnings from both the NWS and local agencies. The success of this effort led to requests from other local agencies and the State Department of Health for similar assistance for extreme heat and other hazards, including air quality and extreme cold.

In addition to local government partnerships, this same WFO worked with a non-governmental organization (NGO) that served people experiencing homelessness. This collaboration assisted the NWS staff in identifying temperature thresholds for both heat and cold whose exceedance threatens the health and life of the unhoused. In working with the NGO, the WFO became more aware that the thresholds were different for those who spent all of their time exposed to the elements. This relationship allowed the WFO to develop customized information for people experiencing homelessness and, by using the NGOs existing networks, to disseminate this information to them.

Interview participants reported successes in improving outreach and education to vulnerable communities that were enabled by leveraging the expertise and communication networks of community partners. Interview participants shared a number of approaches they used to increase the value of their products and services by sharing expertise with external partners. For example, a public health agency helped one WFO understand the impact of specific medications on the ability to regulate body temperature. Working together, they developed heat risk messages targeting the needs of those who take these types of medications. The public health agency distributed this information through their existing networks to ensure that individuals were aware of their risk and the actions that could save their lives.

“One social services group that I walked into, I told them who I was and what I was doing, and at first they were like, ‘Why are you here? Like, we don't do anything with weather.’ But then I explained that I'm looking to find ways to get materials to the elderly, to get materials to the Hispanic population, to get materials to people with disabilities, and they were like, ‘Ah: we can help you with that.’ And so that was a big success.”

Respondent from Central Region

Many of the WFOs cited examples of using the existing networks and communication channels of community partners to increase the societal benefits of their work. For example, several interviewees mentioned the importance of their collaboration with local, state, and national parks that attracted visitors from outside the region who often were unaware of the local weather hazards. To help address this safety concern, some WFOs developed safety brochures that were distributed through park officials and emergency managers. One interview respondent described a state park with a waterfall where multiple fatalities occurred due to rapidly rising water. This WFO initiated the practice of notifying the park ranger when expected rainfall might cause unsafe conditions in that area, improving the safety of all park visitors.

Other WFOs also offered services to university staff for similar reasons, as universities attract students from far away who were unfamiliar with the weather hazards and resources available to help them. Another example of a unique yet fruitful partnership included an WFO partnering with university-based agriculture cooperative extension offices to improve services to the Amish, farmers, and other rural populations. The cooperative extension, with an office in every county, prints and disseminates a monthly newsletter by mail. These newsletters frequently included articles written by NWS staff with seasonal weather outlooks, locally-relevant information on weather safety, and other weather-related topics. Many rural residents prefer to receive information in print, and the newsletter was especially important for reaching the Amish and others with limited or no access to electronic communications. By partnering with agriculture cooperative extension offices, the NWS reached a wider audience and provided valuable weather information to those who may not otherwise have access to it.

“So, what I really want to highlight here, again, is public health, because public health is not traditionally viewed on the same level as the Weather Service's relationship with emergency management. But here at our office now, especially from the planning side, I focus equally on the public health and the emergency management side.”

Respondent from Western Region

Furthermore, several offices have used existing communication channels to reach Spanish speaking populations. One WFO worked with the Latino Chamber of Commerce to reach the local Latino community. Another WFO collaborated with the Consulate of Mexico to provide immigrants from Mexico and other Central American countries with information on hazards with which these communities were unfamiliar, including tornadoes, severe thunderstorms, and extreme heat and cold. This office worked with the Mexican Consulate to record messages in Spanish for the local Severe Weather Preparedness Week. These recordings were then shared over social media platforms of the Mexican Consulate and the WFO. Additionally, this WFO translated IDSS packets into Spanish for the Mexican Consulate to disseminate across their social media platforms and on their website. Although it may not be common for other WFOs to collaborate with entities like the Mexican Consulate, this example underscores the importance of adopting a broad perspective when seeking potential partners to amplify the impact of NWS products and services.

Interview participants described other types of partnerships that existed within and among the WFOs themselves. Within their respective offices, some interview participants noted informal arrangements where staff who were not as comfortable with doing engagement and outreach activities filled shifts for the staff who were more comfortable and really enjoyed interacting with community members. Another participant described the mutual aid provided by a neighboring WFO. Each office was able to execute large outreach events by sharing forecast duties so the entire office was able to reach multiple communities at once. A group of WFOs serving Amish communities demonstrated regional collaboration by creating an informal team that produced materials targeting the specific needs of those communities. For example, they created weather safety materials with content that was tailored to Amish lifestyles. Similarly, two WFOs, each with limited language translation capacity, pooled their resources to translate web-based weather safety content into Spanish.

...my outreach campaign, it was pretty resource intensive. I wanted two people to go out to every one of our counties, visiting all 19 [counties]. [A neighboring WFO] backed us up for three days, and then we turned around and backed them up for three days. So by them covering our operations for three days, I was able to send 10 teams out and reach 10 counties. It did go pretty quick and I was very pleased with that.

Respondent from Central Region

In response to feedback from the state emergency management agency, four WFOs serving Tennessee formed a team to increase the consistency of forecasts and messaging for the state. Through increased coordination and cooperation, they have produced graphics, social media content, IDSS content, and other products that cover the entire state; although not specifically targeting the needs of the socially vulnerable, these improved products could also benefit the communities who are most likely to be harmed by hazardous weather. Due to positive responses from their partners, the four WFOs provided joint briefings for state agencies including the governor's office. The effort did require additional training for NWS staff, as well as internal changes to the way these WFOs developed collaborative forecasts.

While weather forecasts are usually provided for the areas represented by an WFO's County Warning Area (CWA), tribal jurisdictions often cross the boundaries of multiple CWAs. This required tribes to collate various and sometimes contradictory forecasts to get weather information that covers all of their jurisdiction. To address this issue, multiple WFOs whose forecasts cover portions of a region that is home to several tribes, have worked together to synthesize their forecasts to provide the tribes with consistent products that address local conditions in tribal jurisdictions.

In summary, WFOs identified several advantages in broadening their partnerships. Respondents named more than 30 organizations and individuals who are not traditional core partners, but significantly enhance the value of NWS products and services to communities. The expertise, networks, and programs of these partners served as force multipliers for local WFOs. For example, a public health department helped NWS provide targeted warnings of heat risk to those whose medications inhibited their ability to regulate their body temperatures. These relationships also allowed partners to benefit from the expertise of NWS staff, as with the use of

information from the HeatRisk tool to refine heat-related guidance produced by local governments. The approach for developing these community partnerships was grounded in individual initiatives rather than structured and coordinated campaigns, starting small and building relationships based on mutual trust. In addition, NWS staff members were providing mutual aid, both within and among offices, that allowed them to undertake extensive education and outreach efforts without disrupting the weather forecasting mission.

Theme 2: Improving Access to NWS Information

Respondents identified the actions that were taken to improve access to NWS information for historically underserved communities. The interview responses addressed three related topics that are essential to the utility of NWS information: the information must be received, it must be understood, and it must be acted upon. Based on information about the social vulnerabilities in the communities in their CWAs, WFOs developed or continued to implement strategies that supported actions to address these three needs. Respondents described a number of actions to overcome barriers to access faced by hearing and visually impaired persons and those whose circumstances made them hard to reach through commonly-used channels. They also described actions to address the needs of those with low English proficiency, which greatly limited their ability to understand English-language weather information. Finally, WFOs described actions to improve service to those whose ability to act upon vital weather information was limited by poverty, disabilities, or other obstacles. These actions were important to improving service to historically underserved and vulnerable communities.

The Ability to Receive Weather Information

NWS staff members described a number of barriers that prevent certain communities from receiving weather forecasts and other vital weather information and the actions they have taken to overcome these barriers.

Nine respondents, accounting for more than one in four of the interviews, mentioned efforts to improve service to the deaf and hard of hearing, who were unable to receive spoken messages that were not translated using sign language.

Many of the actions focused on increasing the use and effectiveness of sign language. One WFO discussed the addition of American Sign Language (ASL) translation for outreach events noting that a broad range of other social vulnerabilities were present among the hearing impaired. Another WFO added ASL translators to their hurricane preparedness townhalls and developed public service announcements for lightning and rip current safety that were delivered by deaf presenters. This same WFO conducted a VIP tour of a hurricane hunter aircraft for deaf and hard of

“Our social media team just put together some page on our Google site, ...so we've got one specifically related to engaging with underserved and vulnerable populations in terms of colorblind people, people that are deaf and hard of hearing, and how to use alt text in your social media posts and all these things. So that's brand new.”

Respondent from Southern Region

hearing persons to increase the participation of this community in weather safety outreach events. One WFO hired a staff member who was fluent in ASL and was training others. Another WFO began including short recaps of severe weather briefings for the deaf and worked with partners to develop a glossary of key weather terms for sign language. Several WFOs noted their participation in formal and informal training to improve their ability to work with sign language interpreters. Additionally, one WFO increased the use of closed captioning and added graphics to weather safety videos. Another WFO promoted the use of warning systems that do not rely on sound, such as bed shakers and strobes while another reassessed hazard messages like “If thunder roars, go indoors,” recognizing that this message was not effective for the deaf and hard of hearing.

NWS staff also noted a number of measures that have been implemented to enhance services for the visually impaired and blind who are unable to receive written messages that are not 508 compliant. Although most did not mention this legislation, several WFOs cited efforts that align with Section 508 of the Rehabilitation Act of 1973, developing content that was suitable for the colorblind, creating graphics that were accessible for the visually impaired, increasing the use of alt text, and adjusting alt text to improve its readability. NWS staff took other actions to improve service to these communities. One WFO coordinated with a translator who worked with persons who were both deaf and blind to identify methods of reaching this particularly vulnerable population. One WFO reassessed some advisories, such as the lightning warning “See a flash, dash inside,” recognizing it was not effective for the blind. Multiple WFOs worked with government agencies and nonprofit organizations, using the networks of these organizations to expand their reach into blind and visually impaired communities.

Respondents noted the difficulty of providing customized information to residents of mobile homes because they were dispersed across rural and remote locations rather than concentrated in mobile home parks. WFOs reported taking a number of different actions to reach and improve the safety of mobile home residents, but none of them reported an effective means of reaching those in rural or remote locations. For example, one WFO noted that, “as far as the rural location, we’ve always had the mobile home threats for tornadoes [and floods].” Another noted the difficulty of identifying threats to a remote area with a significant number of mobile homes; this area “was way away from every major town and I had no idea it even existed.” It was evident that respondents recognized the need for such efforts; 23 of the 32 WFOs who participated in interviews identified residents of mobile homes as being particularly vulnerable to harm during severe weather events like floods, tornadoes, and hurricanes. NWS staff reported a number of actions that had been taken to improve the safety of mobile home residents, ranging from the development of customized outreach materials to prioritizing outreach to mobile home parks. However, they reported that effective outreach to mobile home residents in rural and remote areas remained a persistent challenge, prompting ongoing exploration of potential solutions.

Some respondents did report success in improving service to another hard-to-reach population—those experiencing homelessness. Six WFOs, some serving large urban areas and others serving rural communities with small towns, cited homelessness as an important source of vulnerability. Although several WFOs discussed the difficulty of providing adequate

service to the those experiencing homelessness, some found success through collaborations with government agencies and nongovernmental organizations with established connections to this community. One respondent noted that those experiencing homelessness cannot receive weather information through ordinary channels; “you can't just walk up to a homeless person and say, here's a weather safety handout... because everything in that pertains to ‘look at your cell phone’ or ‘watch TV’ or ‘if you're in a car’ ... nothing that pertains to them.” To overcome this, one respondent spoke to organizations serving the homeless, saying “if there's something significant coming up weather wise, instead of having entertainment on TV, make sure you have the news on because we found that this is one of main sources for your clients that are coming in, [those who are] living on the streets.”

“So, in order to find a solution to how we find a single point resource for all the shelter information, we partnered with [the public health] 211 and say, ‘Hey, can we use your system as the single point resource?’ And they're like, ‘Yes, that's what we're built for, that's exactly what we do.’”

Respondent from Western Region

A severe cold event was forecasted in the Great Plains region when many of the shelters were closed due to health concerns during the COVID pandemic. One WFO provided early forecasts of the event to partners who served those experiencing homelessness so they had time to set up a shelter in a local convention center with greater space, allowing for safe distancing of individuals as well as providing shelter from cold temperatures. In addition, some site used by the unhoused were located in flood-prone areas; one WFO described their efforts to provide additional lead time to emergency managers to allow them to reach and ensure the safety of those experiencing homelessness when threatened by flooding. Emergency managers assisted this same WFO in finding points of contact within the homeless community “to identify where our services are meeting the mark, or perhaps more importantly, where those communities need[ed] additional information.” Other respondents cited examples of working with organizations that offer essentials like food, shelter, and clothing to disseminate weather information through their networks that directly connect with the homeless.

About half of the respondents noted the vulnerability of travelers and tourists who were unfamiliar with local weather hazards and the resources that were available to help them.

One respondent, for example, described their partnership with rangers at a state park in Tennessee. This collaboration was prompted by several incidents where visitors lost their lives while visiting a popular waterfall due to rapidly rising water. Another respondent said, “I can't tell you how many times I see New York license plates or North Carolina or Florida or Texas. Do they really know what High Plains weather is like? Have they been in a true blizzard or a dust storm with zero visibility?” Similar vulnerabilities were noted in other high-volume tourist destinations like beaches, the Bourbon Trail, and Nashville. Multiple respondents noted that these communities are at a heightened vulnerability to harm from hazardous weather although they would not be flagged by economic or demographic variables.

One WFO has dedicated a page on their website to travelers. This page provided weather forecasts and information on road conditions for Interstate travelers who were unfamiliar with

local weather hazards. It also included safety tips, links to the website for the state department of transportation, and a map showing road closures. To make this information more accessible, the WFO hopes to place signs containing QR codes that link directly to this webpage at truck stops, rest areas, and other spots where travelers stop along the Interstate.

Two coastal WFOs worked together to launch campaigns to reduce the number of deaths in rip currents, creating a website with information on how to avoid and escape from this hazard. For three consecutive years, just before the spring break season, they held campaigns focused on rip current safety with multiple social media posts each day and local media interviews. They also worked to engage inland WFOs in this campaign to reach potential vacationers before they arrived. The interview respondent stated that their long-term aspiration was to have the campaign adopted at the national level. Another WFO has created a sign with QR codes that a local state park can install at the park entrance, boat ramps, trail heads, and other highly visible locations. The QR code will direct users to a website with safety information and weather updates produced by the WFO, with customized information for those engaged in outdoor activities like boating and hiking.

Interview participants described measures that have been implemented to reach other hard-to-reach communities who face significant barriers to receiving NWS information.

Many of the barriers relate to the communities' not using or even being aware of the communication pathways commonly used to access NWS information, including town halls, the internet, and social media. One WFO held a SkyWarn training at a Hutterite community¹⁹ when they were informed by the emergency managers that the Hutterites would welcome that interaction. This opened doors to other outreach to Hutterites, including WFO participation in a 911 Safety Day where students from Hutterite schools were attending with students from the public schools. Another WFO in a major urban center conducted outreach at an organization serving at-risk youth and at a refugee resettlement agency to reach the populations that were served by those organizations. In some of these cases, poverty was cited as a significant barrier to receiving weather information. For example, one WFO asked, "if you have people worried about where they're going to find their next meal, how motivated are they going to be to come out to learn about hurricanes?"

"...it's very obvious that people of color definitely are more vulnerable...How can we help? How can we get the information to, and serve partners that we're probably not serving? Well, if I had someone in my office that maybe looked like them, they would be more receptive."

Respondent from Central Region

This same WFO added weather information to their call-in line to serve a Jewish community that does not use the internet. One WFO worked with Black news broadcasters to form a diversity council to reach students in inner-city schools and, through them, to reach their families. A number of WFOs cited similar efforts to reach historically underserved communities by making initial contacts with students from those communities. One NWS staff member observed that "these kids definitely influence the way their parents and older generations think about things."

¹⁹ Hutterites are a religious community that, like some Amish groups, limit the use of modern technology.

The WFO in Guam worked with USAID and the embassy and consulate of the Federated States of Micronesia (FSM) to develop engagement strategies for reaching FSM citizens living in Guam; the goal was to develop approaches that can also be used to reach FSM and other Pacific Island communities living in the CONUS through their respective WFOs.

The Ability to Understand Weather Information

Most respondents described barriers faced by those with low English proficiency, who were unable to receive weather information in their primary language and were unable to understand fully, if at all, English-language forecasts. In the United States, the majority of individuals with low English proficiency are native Spanish speakers, accounting for 62% of those speaking a non-English language at home. Following English and Spanish, the most commonly spoken languages are Chinese (5%), Tagalog (3%), Vietnamese (2%), and Arabic (2%)²⁰. While NWS has made significant progress in offering weather information in Spanish, the availability of content for other languages remains limited and was being provided only in some parts of the country.

“I’m really glad you all are looking into this. And it seems like one of the end results is sharing best practices, which I think is definitely needed because right now it just kind of seems like for the WCM... we want to do this but we kind of have to figure it out. And so, we’d love for there to be widespread best practices shared because I know I don’t know it all. And I’m always happy to have extra tools to help me out.”

Respondent from Central Region

The interviews revealed that much of the NWS effort to improve comprehension of forecasts and other messages have been focused so far on translating content into Spanish. However, the translation process was described as resource-intensive and many WFOs did not have bilingual staff. While the NWS’s Multimedia Assistance in Spanish (MAS) program did offer translation services, it was predominantly limited to significant weather events, media interviews in Spanish, and short social media posts²¹. To fill the gaps, some WFOs reached out to local educators or Spanish community representatives for translation support, while others sought to hire native Spanish speakers. The feedback collected from the interviews highlighted that the need and demand for Spanish translation services far exceeds the current capabilities of the NWS.

Many WFOs translated static content such as weather safety guides and training materials into Spanish. However, some WFOs stated that they lacked an awareness of which materials had already been translated. Multiple WFOs cited the need for a central repository and venues for sharing information about the availability of and need for translated materials. One respondent noted that a repository would be especially helpful for materials targeting languages that were not present in large numbers within any service area, where there are not “thousands, but

²⁰ U.S. Census Bureau. 2022. What Languages Do We Speak in the United States? Available at <https://www.census.gov/library/stories/2022/12/languages-we-speak-in-united-states.html>. Accessed September 6, 2023.

²¹ National Weather Service. Undated. MAS: Multimedia Assistance in Spanish. Available at https://www.weather.gov/media/ewx/iwt/MAS_OnePager.pdf. Accessed August 26, 2023.

probably 100 to 200 [speakers of the language].” Another WFO noted that, even though some content might be specific to a certain region, like Spanish documents describing High Plains weather patterns, they hoped to find materials that have been translated by others because of their limited translation capacity. This WFO engaged local Spanish teachers in translating content. One WFO suggested that translated materials that are provided by NWS should be editable, allowing them to be customized to reflect local conditions.

One WFO described their work with an emergency manager in an area with Spanish-speaking immigrants who were unfamiliar with the local weather hazards. This WFO worked with the emergency manager to develop a tornado awareness campaign for this community. The interview participant stated that this campaign was designed not only to educate immigrants about the risks but also to dispel misconceptions stemming from exposure to exaggerated depictions in movies and television shows because by dispelling these myths, the immigrant community would be better able to understand the weather hazard and the steps they needed to take in order to be safe.

Participants stated that success in translating weather information into languages other than Spanish was even more limited, presenting even greater challenges to provide communities speaking these languages with weather information that they understand.

While the widespread presence of Spanish speakers across the U.S. makes it possible for different WFOs to work together to produce a considerable amount of translated content²², the situation was said to be different for other languages. The interviews indicated that speakers of languages other than English and Spanish were often concentrated in certain regions and absent from most others. For instance, one WFO stated that Michigan had the largest concentration of Arabic speakers in the country, with the majority located in the Detroit metro area. Another WFO noted the presence of Vietnamese, Ukrainian, and Russian speakers in their CWA. Several different languages are spoken in Guam, including Chamorro—the native language of the indigenous people of Guam and the other Mariana Islands.

“[One meat packing plant] has identified employees whose primary language is one of 26 different languages and dialects. And their model very closely follows ours, in which they identify leaders within those particular languages to help guide their fellow employees. And it's not just at work, they also do stuff outside of work through social media, through things like YouTube. So, this provides some good indication of where we need to go in order to be successful.”

Respondent from Central Region

Participants also noted that speakers of languages other than English and Spanish were often concentrated in agriculture and related economic sectors. Multiple respondents noted that the

²² Although it is possible for NWS offices to work together in Spanish translation, interviews indicate that many are not doing so. There is no evidence in the interview content of widespread awareness of progress by other WFOs; multiple archives of translated content exist. Addressing this gap presents an excellent opportunity for immediate, low-cost gains on this front.

agriculture industry drew a diverse range of workers from central and eastern Europe, South Africa, and other parts of the world. Another WFO described a poultry plant in Missouri where 26 distinct languages and dialects were spoken by its workers.

One interview participant reported a conversation with a neighboring WFO on reaching communities that do not speak English, presuming that the conversation would be about reaching Spanish-speaking communities. However, his colleague responded by asking which of the 20 languages spoken in his CWA he wanted to address.

One WFO described their support to the Michigan Ready (MIREADY) program, led by the Michigan State Police, in translating into Arabic materials that help residents prepare for weather and other emergencies. Another WFO supported a new national workgroup called Language & Accessibility in Alert and Warning Workgroup (LAAWW), which included “subject matter experts in emergency alert and warning systems, language equity, disability access, public information, and disaster communication.” In their initial translation effort, LAAWW produced heat messaging like impact warnings and calls to action in 26 different languages. In the past year, LAAWW expanded the scope of this project to include winter weather messages and they were working on messaging for several other hazards. Local WFOs provided quality control for the English versions of messaging. This product was available for use by NWS.

Multiple WFOs noted a lack of diversity within their teams that led to difficulties in communicating with those who are not fluent in English. Although some respondents described efforts to address the lack of diversity, several noted a persistent shortage of staff who were proficient in Spanish. This challenge was even more pronounced for other languages. Other WFOs said that service would be improved if the composition of their staff reflected the racial and ethnic composition of the communities that they serve.

Overall, respondents noted numerous challenges that affected historically underserved communities; ability to understand weather information. Current translation practices and resources were not viewed as sufficient to meet the needs of our diverse nation where many languages are spoken, often by small communities dispersed across many service areas. While a few WFOs found ways to increase their capacity to provide translated materials, many offices cited the need for greater coordination across WFOs to share expertise, address common needs, and share translated content.

The Ability to Act Upon Weather Information

Interview participants described a number of vulnerabilities that could limit an individual’s ability to act upon weather information to reduce their losses and increase their safety. As noted above, most of the interview participants identified poverty as a key vulnerability, with 7 citing lack of access to a vehicle as a significant vulnerability in their service area. As one respondent stated, “...when it comes to hurricanes, anything that revolves around money and transportation is the most important. That tends to be why people don’t evacuate, they don’t have the money to leave their job, they don’t have a car, somewhere to go.”

Although mentioned less frequently, two examples of efforts to reach persons with disabilities could contribute significantly to saving lives if more broadly adopted. One WFO described an initiative that focused on adjusting the content and timing of messaging to account for medically handicapped individuals who may need additional time to prepare for and respond to weather emergencies. The respondent noted that this was especially relevant for persons in their own home who were confined to a bed or reliant on respiratory aids like oxygen machines. Another WFO described an initiative that provided emergency managers and first responders with statistics on elderly, mobility impaired, and other vulnerable persons in tsunami prone areas, enhancing their ability to serve these populations more effectively.

Although several of the interview participants noted that the NWS cannot rely solely on technological solutions to reach socially vulnerable communities, some of these same respondents identified benefits of Internet-based and other technological approaches for improving service to vulnerable communities (see diagram below). Some examples have already been cited in this report, including the use of QR codes to provide travelers and outdoor recreation participants with access to information on local weather hazards and current conditions. Several other respondents described their successes with emerging technologies and innovative applications of existing ones. One WFO has worked with emergency managers to use the state’s existing 211 community referral services call line to disseminate information on shelter locations during heat and cold emergencies. They have also promoted information about the 211 system and relevant calls-to-action through social media posts. The respondents mentioned using multiple methods and modalities frequently for increased reach and access.

Respondents who cautioned against over-reliance on technological approaches

Respondents who identified benefits of technological approaches

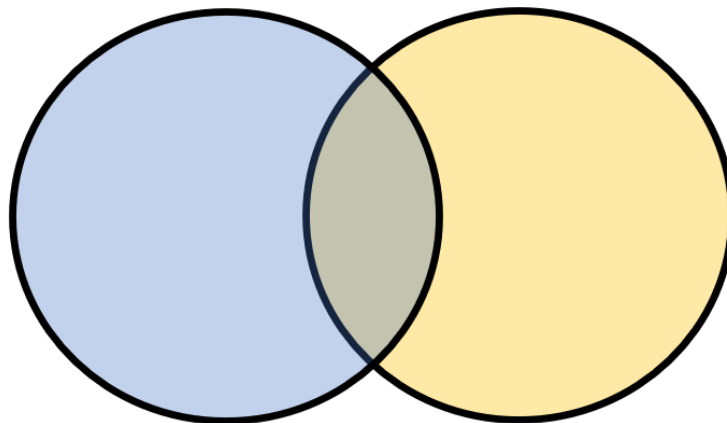


Figure 4: Comparison of Responses on the Limitations and Benefits of Technological Approaches to Improve Service to Vulnerable Communities

One WFO collaborated with state park officials on the use of sirens to warn campers of severe weather and flooding 24 hours a day. Another WFO worked to expand weather radio transmission networks to expand their reach to rural, isolated populations. Other WFOs noted their use of recorded weather updates that can be accessed by telephone for those who do not have reliable access to the Internet and those who do not use the Internet. One WFO promoted the adoption and use of solar or battery powered weather radios by Amish communities who were not connected to the electrical grid. Two respondents discussed their work with smaller, local radio stations to reach rural populations including Alaska Native communities. One of these respondents noted the importance of working with AM radio stations, which have a large reception range.

“Facebook is a huge thing in rural Alaska; the communities communicate through Facebook now, which is kind of a revolution. Before, they used to use VHF radio, which they still do to some extent.”

Respondent from Alaska Region

Overall, NWS staff reported a broad range of actions that make it possible for vulnerable communities to access, understand, and act upon vital weather information. Several of these actions focused on addressing the barriers posed by disabilities like hearing and visual impairments. Others cited actions focused on hard-to-reach communities that were particularly vulnerable, like those experiencing homelessness, travelers, vacationers, and residents of mobile homes. Language barriers were the most commonly-cited obstacle to understanding weather information. Most commonly, respondents cited efforts to provide weather information in Spanish, which is the dominant non-English language in the U.S. Multiple respondents noted the need for an archive of translated materials to reduce duplication of effort and increase the utility of the translated content that already exists. Finally, a few respondents cited examples of actions that improve vulnerable individuals’ ability to act upon weather information, providing outreach targeting the needs of persons with mobility impairments that require additional time for taking protective actions.

Theme 3: The Vital Importance of Core Partners

Although the interview respondents described numerous advances they achieved through community partners, they consistently emphasized the vital role of core partners. These partners include emergency managers; federal, state, and local government entities that closely coordinate with the NWS; and media outlets and others who “routinely and rapidly relay weather and water watches, advisories, warnings, and forecast information²³.” WFOs identified a number of enhancements to these longstanding relationships that enabled them to improve service to vulnerable communities.

²³ National Weather Service. Undated. Core Partner. Available at <https://www.weather.gov/car/CorePartner#:~:text=NWS%20Core%20Partner%20Definitions%3A,that%20are%20influenced%20by%20weather>. Accessed August 25, 2023.

Respondents recognized core partners as their primary source for understanding vulnerabilities in their service areas.

Published indices like the SVI provide information on the presence of socially vulnerable communities but, as noted above, they do not reflect the full range of social factors that were linked to vulnerability. Multiple respondents noted that core partners helped them fill these gaps, with just over one-third of the respondents identifying emergency managers as one of the primary means by which they identify vulnerable communities. For example, one respondent stated that “we’re trying to work with our core partners, namely emergency managers, ...because they know their communities better than we do. ...these are local issues, and there’s no way I will ever fully understand the local issues.”

But we have to rely heavily on our emergency managers because with 46 counties and five and a half million people you just can't get into the weeds without having somebody ... letting us know this is where we need work and this is where we need help.

Respondent from Eastern Region

NWS staff reported that core partners were crucial not just for identifying existing vulnerabilities within their service areas, but also for connecting with these communities.

NWS staff noted that their outreach efforts were often hampered by the expansiveness of their service areas, the multitude of jurisdictions, and sometimes, the size of the populations they serve. They also reported that these same factors make it difficult to understand local vulnerabilities. However, they reported that core partners operate at a more localized level and are, thus, “much more in tune with the nuance of their particular communities than we could ever be.” They also noted that core partners facilitated outreach by providing points of contact and established relationships of trust through which vulnerable communities can be served.

Several respondents described how collaboration with core partners deepened their understanding of the needs of vulnerable communities during hazardous weather events.

One WFO described how, after severe weather events, they participated in Incident Command Post teams, witnessing firsthand the tactical management of weather-related crises. They reported that this direct involvement gave them a clearer view of how weather crises were tactically handled, deepening their knowledge of both the emergency protocols and the specific needs of communities at risk. This engagement also helped to ensure that all participants were “speaking the same weather language,” enhancing communication and improving the support provided to vulnerable communities. Another WFO described their participation with U.S. Army Corps of Engineers “Silver Jackets” teams²⁴,

“A great thing to like about the town halls is it’s often you get an opportunity to listen to the community. So, it’s not just about us talking. It’s about us listening to them and hearing how they can better serve their own communities and what their needs are.”

Respondent from Southern Region

²⁴ Silver Jackets are interagency teams that facilitate collaborative solutions to flood hazards. Through their shared knowledge, Silver Jacket teams enhance preparedness, mitigation, response, and recovery

obtaining information on flood-prone areas that were being analyzed to identify risks to socially vulnerable communities.

The interviews revealed significant variations in staffing and resources allocated to emergency management functions across different areas. NWS staff reported that, in large counties or urban centers there were typically dedicated full-time emergency managers or entire emergency management departments. However, they reported that this varied greatly depending on the jurisdiction’s population and affluence. One interviewee said that “a lot of the partners around here have multiple jobs. One of my emergency managers is the emergency manager of three counties. I have several that are emergency managers and the county sheriff and, of course, their law enforcement comes first, not emergency management. Most of my emergency managers are part time. I have another emergency manager that owns his own liquor store and runs that business; and then he runs medical labs...” Another WFO reported that, in small counties and tribal jurisdictions “one person wears probably 20 hats.” Respondents stated that, for this reason, they adapted their interactions with emergency managers to suit each unique operational environment.

“One of my emergency managers is the emergency manager of three counties. I have several that are emergency management and the county sheriff and, of course, their law enforcement comes first not emergency management. Most of my emergency managers are part time. I have another emergency manager that owns his own liquor store and runs that business; and then he runs medical labs... So he doesn’t exactly have a lot of time to be printing off materials and distributing them to his community.”

Respondent from Central Region

Respondents reported that they continue to place a strong emphasis on their longstanding partnerships with media outlets and found new ways of communicating with hard-to-reach communities. Multiple WFOs noted that television remains an important source of weather information, especially among rural and elderly populations. One participant, however, noted that the rural communities in their service area were five hours or more away from the local television station, leading to weather broadcasts that often fail to provide locally relevant information. Multiple respondents noted that radio continues to be an important source of weather information, especially for non-English speaking communities like Spanish and Arabic speakers, certain professional groups like construction workers, and specific rural communities, such as Alaska Native populations.

In addition to their support to members of the electronic media, some WFOs contributed weather-related content to newspapers and other print media, which they reported to be instrumental in reaching specific vulnerable communities. One newspaper reported to the local WFO that 80% of their readership was elderly. Some members of religious groups, like the

efforts when floods occur. For more information, see U.S. Army Corps of Engineers, Institute for Water Resources. Undated. Silver Jackets: Many Partners, One Team. Available at <https://www.iwr.usace.army.mil/Silver-Jackets/>. Accessed on September 6, 2023.

Amish, do not receive information through electronic media. To address this, one WFO submitted articles to a local newspaper serving the Amish, farmers, and other rural communities. Another WFO contributed articles on weather safety directly to a newspaper operated by an Amish community.

Overall, the insights gathered from the interviews underscored the indispensable role of core partners in enhancing the NWS's ability to serve vulnerable communities. NWS staff stated that these partnerships provided a crucial link to localized knowledge and networks, addressing gaps that indices like the SVI cannot fill. They reported that their relationships with core partners helped them to overcome a wide range of challenges, such as those associated with serving vast service areas, numerous jurisdictions, and large populations. Several interviews cited collaboration with core partners as an important means of improving their grasp of specific needs, helping them reach and serve vulnerable communities more effectively. They reported wide-ranging interactions with core partners, from participating in hands-on emergency management to contributing content for print and electronic media. Interview responses indicate that relationships with core partners were vital in ensuring that even the most isolated or unique communities were not left behind when it comes to critical weather-related support and information.

NOEES Upgrades: A Significant Opportunity

According to the governing NWS directive²⁵, the NWS Outreach and Education Event System (NOEES) was created to “compile outreach and education event information and user feedback within the NWS in a timely, accurate, and consistent manner.” The directive states that “[e]vents and updates should be entered into NOEES as soon as they are known and/or completed. Timely reporting helps to ensure accuracy and completeness of the information entered. It also ensures that any reports run on NOEES include the most up-to-date information.” Responses to the screener survey and interviews indicated that NOEES was no longer performing this function effectively and, instead, was viewed by WFOs as prohibitively inefficient and provided no value to local WFOs. Many WFOs reported that, for these reasons and others discussed below, their use of NOEES no longer provided “timely, accurate, and consistent” information.

Most WFOs reported that they do not enter data into NOEES immediately after outreach events. In response to the screener survey question about how often they input their engagement activities into NOEES, almost half of the 58 respondents replied “sometimes,” “rarely,” or “never.” About a quarter indicated that they “always” recorded events in NOEES, with the remainder reporting that they “often” recorded events. The interviews probed deeper, asking about the timeliness of data entry. Only one respondent indicated that their office recorded events as they occur. Several stated that they recorded data less frequently, with two reporting that they enter NOEES data at the end of the year, often citing the inefficiency of NOEES as the reason. Many respondents stated that they kept good records of outreach events in

²⁵ National Weather Service. 2019. Directive 10-1804 Outreach and Education Reporting Requirements.

spreadsheets, shift logs, or calendars and used this information to update NOEES later. For example, one respondent noted that their offices had a “Google spreadsheet that is very user friendly” that was used to record data on outreach events that was later transcribed into NOEES. Another said that “[e]very October I have what I call NOEES days, where I go in and log all my visits at one time, ...I will suffer with data entry for two full days but then I'm done with it.”

Interview responses indicate that the information recorded in NOEES was inconsistent across and even within WFOs. Some offices considered certain activities to be IDSS, which they excluded from NOEES but other offices considered those activities to be outreach events and recorded them in NOEES. Another source of inconsistency was reported by one staff member who said, “you look at one office and they've had 10 [NOEES] entries. And you look at another office and they've had 4,000. And you're like, What? Something's wrong.” Another NWS staff member stated that “a lot of the outreach and education that we do is on social media and we're not putting any of that stuff into NOEES. If we create an educational video or a series of tweets that explain a phenomenon, that's outreach and education, but we're not putting that information in the NOEES at all.”

Data entry into the NOEES system was hampered by the inflexibility of its design. One staff member described NOEES as “wildly inefficient” while others stated that NOEES failed to capture the full extent of their outreach, underreporting their efforts by up to 50 percent. Multiple WFOs reported that the system's design inherently limited its completeness. They noted, for example, that NOEES lacked a feature to specify the locations of communities served by virtual events or those held on NWS premises. One respondent stated that, in areas with socially vulnerable communities, there were often no venues that were suitable for outreach events; thus, events were hosted in a nearby area whose location was recorded in NOEES, providing an inaccurate indication of the location of the community that was being served. Another respondent cautioned against reading too much into maps showing the location of outreach events because jurisdictional boundaries often included water, wetlands, and other uninhabited areas. Such maps could give a misleading impression of neglect in certain areas; “it's marshland; I would have to put a boat out there to put a dot there.”

Improving NOEES is a great opportunity to increase the efficiency of NWS operations and the quality, completeness, and consistency of the NOEES data, which will increase the time available for conducting outreach and improve the morale of those with data entry responsibilities. The interview respondents were universally helpful, professional, and generous with their time. However, it would be difficult to overstate the strength of their negative responses to questions on NOEES. When the topic was introduced, multiple respondents indicated that they hoped we would discuss NOEES and only a few respondents failed to express their dissatisfaction with the data entry process. One staff member said, “I mean, it's just lazy. We have so many talented people that could come up with some database that's easy to use.” Others provided specific suggestions for improving the interface, with multiple respondents suggesting creating a means to allow them to import data from their calendars or some other more efficient data entry platform. Multiple staff members reported that the

performance of NOEES indicated that it was a low priority for NWS leadership and, thus, was given low priority in field offices. One staff member stated that, “until they improve that software program that is from like 25 years ago, then that tells me they don't really care,” leading another to conclude that “it is a low-priority system.” The latter respondent also stated that their staff members “don't see the return on that time investment to do it so it's not done to the level that it could be done.” Another respondent said that, “a few years back at a national WCM conference, they told us they would get back to us with a demonstration of how the data was being used and we've never heard about that ever again.” Only two interview respondents reported making internal use of the NOEES data. The impact of NOEES on staff morale was indicated by the strong language used to express dissatisfaction, ranging from “cumbersome” and “kind of clunky” to “dumpster fire.” One respondent put it this way, “I'm gonna be real honest with you. NOEES is trash, it is trash. It's not easy to use. ... I hate it. I don't like it. If you want a list of things, I'm more than happy to give it to you.”

Overall, the feedback from respondents showed a critical disconnect between the intended function of NOEES and its actual utility and operation in the field. Despite its original purpose of compiling outreach data in a “timely, accurate, and consistent manner,” respondents described NOEES as a cumbersome system that fails to meet these objectives, with flaws ranging from an inefficient interface to the inability to accurately reflect the full spectrum of outreach activities. Interview respondents reported that discrepancies in the use of NOEES across and within WFOs and the system's inability to capture the nuances of real-world outreach efforts further eroded its reliability and effectiveness. The broad theme of the discussions was that investments in improving NOEES could restore the system's potential as a valuable resource rather than an administrative burden.

Conclusion

This report provides an extensive overview of the experiences, achievements, and obstacles that NWS field offices have encountered in their efforts to improve service to historically underserved and vulnerable communities. Interview respondents noted several challenges they faced, but despite these challenges, they also described a large number and wide range of actions that have been taken to improve products and service to their communities, many of which have been highly successful. The respondents emphasized the indispensable role of local knowledge and collaborations with core partners and community partners in identifying and addressing the unique vulnerabilities of their service areas. Challenges such as staffing, funding, diversity, and the limitations of the current NOEES system have been highlighted, showing a pressing need for more resources and system improvements. Respondents also provided accounts of numerous accomplishments and the application of innovative approaches, leading to significant progress and demonstrating the commitment of WFOs to improving products and services to historically underserved and vulnerable communities. These include the significant progress in language translations, enhanced access to services for individuals with disabilities, and the formation of beneficial partnerships that have allowed for knowledge exchange and more effective access and dissemination of life-saving weather information.

During this study, NWS published a companion document on Equitable Services for a Weather-Ready Nation (March 2023). Although the two efforts were independent, they reached a number of similar conclusions about the importance of:

- building trust with communities and partners,
- increasing our understanding of vulnerable communities,
- providing weather information in languages other than English,
- recruiting and maintaining a diverse workforce, and
- modernizing NOEES.

Both reports support the recommendations collected from field offices which includes focusing on modernizing NOEES and improving accessibility to translated materials. Notably the NWS has accepted these recommendations, and has taken actionable steps towards improving NOEES by developing a working group to support the development of a new intake process and dashboard, as well as improving language translation service by standing up a new Language Program within the Office of Science and Technology Integration committed to collaborating with offices across the NWS to support communities, and ensuring that the evolving needs of every community are met efficiently and inclusively.

Appendix A: Survey Protocol

Hello and thank you for agreeing to participate in the NWS Social, Behavioral, and Economic Sciences (SBES) Program's survey regarding your current community engagement activities. The responses to this short survey, which will take less than 5 minutes, will help us identify how WFOs, Regions, and Centers are currently improving services to communities identified by the [CDC's Social Vulnerability Index](#) as "vulnerable." Social vulnerability refers to socioeconomic and demographic factors that indicate that a community is more likely to be adversely affected by hazards and less able to recover from them.

This effort seeks to understand and identify best practices already being implemented by the NWS, in the hope that some of these practices may be applicable to other WFOs, Regions, and Centers. Please note that the survey will close on March 15, 2023.

Thank you again for your participation. If you have any questions or would like additional information please contact:

Jeff Adkins
jeffery.adkins@noaa.gov
NWS Office of Science and Technology Integration
Social, Behavioral, and Economic Sciences Program

1. Your Name: [Text Box] [required question]

2. Your Title: Please select one. [Drop down list, select one] [required question]

- Warning Coordination Meteorologist
- Service Coordination Hydrologist
- Science and Operations Officer
- Development and Operations Hydrologist
- Meteorologist-In-Charge
- Hydrologist-In-Charge
- Other [text box]

3. Your Affiliation. Please select one. [radio button, select one] [required question]

- Local Weather Forecast Office
- Regional Headquarter
- River Forecast Center
- National Centers for Environmental Prediction
- Other

5. NWS Offices are engaging with communities in multiple ways, such as developing partnerships with local health and human services hotlines to disseminate forecasts of extreme heat, working with Spanish language media outlets, and developing integrated weather

forecasts for Native American communities whose territory is divided among multiple WFOs. Does your office engage in education, outreach, and training activities or develop products that are designed to improve services to communities that may be vulnerable?

[yes/no, select one] [required question]

- Yes [Go to Q6]
- No [Go to end of survey]

6. How would you describe the type of engagement activity conducted by your office? Select all that apply. [multiple choice, select many][required question]

- Educational seminars
- Training sessions
- IDSS briefings
- Community meetings
- Translation services
- Other [text box]

7. On a scale of 1 to 5, with 1 being never and 5 being always, how often do you input your engagement activities into the NWS Outreach and Education Event System (NOEEs) database? [5 point Likert Scale] [required question]

1. Never
2. Rarely
3. Sometimes
4. Often
5. Always

8. Would you be willing to speak with us for about an hour to discuss further what your office is doing to improve services to communities that may be vulnerable? [Yes/No, select one] [required question]

- Yes [go to Q 9]
- No [end of survey]

9. Please provide your email address so we can schedule an interview. [text box] [required question]

Thank you for your time.

Appendix B: Interview Protocol for Community Engagement Activities

Pre- and Post-Interview Information

Interviewers:

Interviewee:

Affiliation of Interviewee:

Title of Interviewee:

Documents and Links Obtained:

Leads and Post-Interview Comments: [Add after interview, as appropriate.]

Introduction Protocol

Hello [Interviewee name],

My name is _____ and, along with my colleague _____, we are with the Social, Behavioral, and Economic Sciences Program at the NWS HQ. Thank you so much for agreeing to participate in this interview and taking time out of your busy schedule to chat with us.

The purpose of this interview is to understand how your office has engaged with communities identified by the Center for Disease Control's Social Vulnerability Index as vulnerable. This index, which we'll call the "SVI," uses socioeconomic and demographic factors to indicate that communities may be more likely to be adversely affected by hazards and less able to recover from them.

We will use the information gathered from these interviews to document practices designed to improve service to vulnerable communities in the hope that some of them may be applicable to other WFOs, Regions, and Centers. We will be asking you questions focused on three areas: your understanding of your communities, the activities you initiated, and the outcomes from the activities.

The interview will take less than an hour, and you are welcome to skip or decide not to answer specific questions. Please know that you may stop the interview at any time. I would like to ask your permission to record this interview for note taking purposes only. We will delete the recording once we have analyzed the data. Are you ok with us recording this conversation?

Thank you again for your time and cooperation. Before we begin, do you have any questions for me?

Community Engagement Activities

1. Confirm pre-survey information (e.g., name, affiliation, title)
2. How many years have you been with [current affiliation]?

Our next group of questions will focus on the communities that you serve:

3. We mentioned during the introduction the CDC's SVI. Let me share my screen with you and display the Index. It's not important whether you have used this index or even knew about it prior to our conversation. The main reason we are sharing the index is that it provides us with a starting point to discuss vulnerabilities that may be present in your communities.

[While showing the SVI to the interviewee.] The SVI includes four major categories of indicators, called themes- they are socio-economic status, household characteristics, racial and ethnic minority status, and housing type and transportation. Within these themes, the SVI also includes fifteen indicators. [Give them a second to read through the themes and indicators].

- a. Of the themes and indicators listed, which ones would you consider priority concerns for the communities within your area of responsibility? [Probe for how they would even rank some of these vulnerabilities, are some more prevalent in their communities than others?]
 - b. What would you consider the top three indicators for your communities?
 - c. Are there other indicators or factors that are important for your communities that are not in this index?
4. How are you determining and keeping abreast of the vulnerabilities within your area of responsibility? [Probe for both formal and informal information gathering activities, such as speaking with partners, social media, use of secondary research from others, etc. What is the evidence for the ranking they provided above?]
 5. Your response to the survey in early March indicates that your office has developed specialized outreach activities, IDSS, or other specialized products or services that are designed to improve services to communities identified by the SVI as vulnerable. What specific attribute (or a set of attributes) of the targeted community prompted the decision to improve service to those communities take these actions? [Probe for motivation, why did they decide on the attribute/issue to develop an activity? Did something happen that prompted their response, etc.?]
 6. Given some of the attributes we discussed, how did you determine/define the problem or the need that your activities were designed to address? [Probe for data, research,

conversations, etc. they used/had to determine that based on the attributes there was a problem/need to access/understand weather information.]

If explanation is needed: Some problems that were identified in other interviews include communities with low English proficiency who were not receiving forecasts or other information in their native language and indigenous communities whose territorial boundaries lie at the intersection of multiple WFOs and, thus, often receive conflicting or incomplete information.

Now we would like to focus on questions regarding the activity(ies).

7. Can you please describe the actions (set of activities) that were taken to address the problem(s) you just described?
 - a. Have collaborated with partners (Public Health Seattle King County) to align NWS impacts with public health recommendations, this has spread to other counties in Washington and are asking for information for other hazards (winter, cold, etc.)
 - b. Grant proposal with University of Washington School of Public Health/Public Health Seattle King County to develop impacts for cold/winter weather
 - c. Work with coastal tribal nations
 - d. Joined the Language and accessibility in alert and warning (LAAW) working group of individuals across the country (recently organized working group)

If explanation is needed: This might include, for example, developing partnerships with Spanish language media outlets to disseminate weather information to those with low English proficiency and developing integrated weather forecasts for indigenous communities whose territory is divided among multiple WFOs.

8. How were/are the activities managed and staffed?
 - a. How resource intensive were/are the activities? Majority of work is with jurisdictions and agencies, and primarily is done by WCM (Reid); not providing specialized IDSS, but more work is being done on the planning/pre-event planning; hasn't increased staff's workload, but does increase WCM's workload
 - b. Were the activities designed to be long term or were they designed to mitigate a short term issue? Short-term activities (planning, pre-event activities) provide long term results
 - c. If they were/are designed for long-term engagement, do you believe that the WFO will be able to sustain some of these activities?
 - d. Were the activities designed to be long term or were they designed to mitigate a short term issue?
9. Did you work/partner with groups, agencies, or other "partners"?

- a. Can you describe their contributions and how critical you think their participation was to your success? Emphasized the importance of a strong relationship with public health partners (a deep core partner for their office), especially for the planning activities; a critical component of enhancing service equity because public health has the relationships and communication with vulnerable communities
- b. Were you able to use or leverage existing resources developed by some of your partners? [Probe for both traditional and non- traditional partners they worked with, resource sharing, and how they leveraged existing networks for communication and dissemination.]

Finally, we will move into our last set of questions that will focus on outcomes and lessons learned.

- 10. What were some of the anticipated outcomes for your activities? [Probe for what they thought would happen prior to the start of the activities, their expectations for the activities.]
 - a. What were the actual outcomes of the activities? [Probe if what they expected actually happened.] Washington 211 partners has increase in people accessing the information; successful framework for heat developed with public health partners; identified the difficulty of measuring impacts of outcomes if a weather hazard has not occurred
 - b. Were there any unintended consequences?
- 11. Do you believe that the actions/activities you implemented helped to resolve the problem(s)? Yes, but noted the challenges of getting messages to populations through several communication channels (such as if someone doesn't have access to social media)
- 12. How do you know that your activities helped to resolve the problem(s)? [Probe for feedback from stakeholders, social media, any type of information gathering they may have conducted to understand their reach and impact.] Traffic to 211 website, feedback from partners for health recommendations, and request from partners to extend the work that has been done for heat hazards
- 13. Did you run into obstacles/challenges while implementing your activities? A buy-in problem, and manpower challenge (may need help from a forecaster)
- 14. What do you believe went well with the activities? The relationships with public health partners (now doing joint presentations), now have increased invitations to speak at public health meetings/events

15. Would you do anything differently if able to do this again? Would prioritize action items because it can become overwhelming to manage all

16. Our program likes to use NOEES data to analyze and map the number and location of outreach and education events. Have you used the NOEES database before? [Probe for why they use the database. In addition to entering data, do they also use the system to pull information, learn about activities done in the past, other offices, etc.?
 - a. How often do you/the office input data into the system?
 - b. Does the NOEES data represent the outreach and education activities of your office well?

17. Are there any other comments you wish to share?

18. Do you have documents, slides, or links you can share that will help us understand this effort?

Thank you for your time.



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