NOAA Environmental Literacy Program Resilience Education Grantee Workshop

Report of a Workshop Convened by the NOAA Office of Education
September 13 and 14, 2017
at the Museum of Science, Boston

Sponsors:
NOAA and National Marine Sanctuary Foundation
Hosted by:
Museum of Science, Boston

Credit: Eric Workman (Museum of Science, Boston)

Contents

Acknowledgements

Support for the workshop was provided by the National Marine Sanctuary Foundation and NOAA's Office of Education.

This report was written by Maggie Allen and Patrick Drupp in consultation with the Environmental Literacy Program team members Jaime Frungillo, Carrie McDougall, John McLaughlin, Christopher Nelson, and Sarah Schoedinger.[1]

The Environmental Literacy Grants team appreciates the support and engagement of all NOAA participants; in particular we thank Louisa Koch, Christos Michalopoulos, Josh Murphy, Frank Niepold, Dan Pisut, and Adam Stein for serving as speakers as well as active participants. We also thank our guest speakers, Cara Pike, Executive Director of Climate Access, Austin Blackmon of the City of Boston, John Bolduc of the City of Cambridge, and Julia Knisel of the Massachusetts Office of Coastal Zone Management.

We thank the Museum of Science for hosting this workshop, particularly David Sittenfeld and Emily Hostetler for helping organize and facilitate the workshop.

Finally, this event would not have been possible without all of the passionate resilience grantees that joined us in Boston from across the country for two days of shared learning. Thank you for participating, and we look forward to continuing this important work with you.

[1] Recommended citation: National Oceanic and Atmospheric Administration. (2017). *NOAA Environmental Literacy Program Resilience Education Grantee Workshop*. Retrieved from NOAA website. www.noaa.gov/sites/default/files/atoms/files/PDF-ELP2017GranteeWorkshopReport-110117-NOAA.pdf

NOAA Environmental Literacy Program Resilience Education Grantee Workshop

On September 13 and 14, 2017, NOAA's Office of Education held the Environmental Literacy Program Resilience Education Grantee Workshop at the Museum of Science in Boston, Massachusetts. The workshop convened the 13 recipients of Office of Education grants awarded in 2015, 2016, and 2017 through Environmental Literacy Grant competitions. These grants are focused on building the environmental literacy necessary for community resilience to extreme weather events and other environmental hazards

The Environmental Literacy Program (ELP) offered its first community resilience-focused funding opportunity in 2015 and awarded six grants. Seven more projects were funded through a second funding opportunity in 2016-2017. Projects and institutions are listed in Appendix C. With 13 grantees at various stages of implementing their projects, the primary goals of the workshop were to begin building a community of practice and to share lessons learned about challenges, opportunities, and best practices for improving community resilience through education initiatives. The two-day workshop included presentations from each grantee, a panel about resilience-related NOAA assets, a social science keynote presentation, breakout sessions, and a panel of local community planners. The full agenda can be found in Appendix B.

The Environmental Literacy Program has been funding formal (K-12) and informal education projects that support NOAA's mission since 2005, but its focus on community resilience began in 2015. The change was made to help provide meaningful solutions and actions, beyond basic environmental literacy, to communities and citizens seeking to mitigate and adapt to extreme weather events and climate change. The prior success of other collaborative efforts the Office of Education has helped organize—the Science On a Sphere Users Collaborative Network, the Tri-Agency Climate Change Education Collaborative, and the Coastal Ecosystems Learning Center Network—was a motivating factor in convening this workshop and creating a community resilience education network to improve collaboration and coordination among project teams, institutions, and NOAA.

Building resilient communities is a core component of NOAA's mission, and has increasingly become a focus at all levels of government (ELG FFO 2016), but using environmental and science education to create resilient people and communities is a relatively new field. A dearth of information regarding best practices exists for these projects to build on, so it is critical for success that a strong, collaborative network is formed to facilitate the development and implementation of effective resilience-based education programs.

The workshop's objectives were to 1) increase collaboration and build camaraderie among ELP resilience grantees and 2) share information and lessons learned on ELP resilience projects,

including emerging best practices for resilience education projects and solutions to implementation challenges. Overall, this workshop served as a launching point to help the grantees collaborate and learn from each other. It also informs NOAA on how education can best be used to serve local communities as they prepare for and adapt to extreme weather events and other environmental hazards.

Role of education in community resilience

Communities and the nation face challenging economic, social, cultural, and environmental choices about the best ways to ensure basic security and quality of life against environmental stressors. One way to reduce the impacts of hazards on the nation and its communities is to invest in enhancing social-ecological resilience. Social-ecological resilience implies a system can adapt and transform in order to maintain processes in response to steady and small-scale shifts or in the face of overwhelming change (Berkes et al. 2003). Enhanced social-ecological resilience allows communities to more effectively anticipate environmental hazards and to better plan to reduce losses (National Research Council 2012).

Education can play a key role in how environmental hazards are alleviated through public policies for managing the risks and uncertainties related to environmental change (Walker and Salt 2006). Resilience education can help individuals understand scientific processes and the ways that human and natural systems interact (NOAA's Education Strategic Plan 2015-2035), which ultimately enables communities to make informed decisions that reduce their vulnerability to environmental hazards and stresses. Knowledge of social-ecological resiliency could potentially radiate throughout the community, with youth learning from adults and vice versa (Krasny and Tidball 2009).

Strengthening connections between community resilience initiatives and education efforts is key to ensuring that local communities make informed decisions to expect, prepare for, respond to, and recuperate from substantial dangers and stresses, with minimum damage to human well-being, the economy, and the environment (ELG FFO 2016).

Shared Learning at the Workshop

The funded projects use a diversity of approaches to reach diverse audiences. The workshop gave the project teams a chance to share their lessons learned.

Project highlights and impacts

Each project team gave a brief presentation about their work, including successes and challenges. Although the majority of projects are in the beginning of their work, project representatives discussed early successes and notable impacts they were experiencing. For example:

- Califa helps public libraries advance community engagement and improve environmental literacy through climate change discussions and book clubs. These discussions are often robust, engaged, and civil, and are adapted to local concerns so that the participants may become active locally.
- The Gulf of Maine Research Institute has hosted five programs that have engaged 143 participants. They have noted increased participant knowledge about sea level rise, its impacts, the role of data in decision-making, and the associated resiliency options following the activities.
- Arizona State University and the Museum of Science, Boston have hosted citizen forums to discuss resilience to various extreme weather events like heat waves to facilitate public deliberation and inform future planning and education efforts.
- The Maritime Aquarium at Norwalk has developed a role-playing game for use in classrooms that will have students catalog areas of vulnerability and create their own coastal management plan in a role-playing game back in the classroom
- Multiple organizations, such as Nisqually River Foundation, Groundwork Hudson Valley, and Brooklyn College, noted that teachers are more confident in teaching climate change in their classrooms following training, and these projects help them incorporate this knowledge into their curricula.

During the project introductions, grantees noted common approaches that have worked for them. For example:

- Building the confidence and knowledge of museum presenters who provide public programs was a key challenge for almost every group. The Science Museum of Virginia is working with their museum educators to be more confident when communicating climate science to visitors. They also attributed their project's success to the fact that they have complete institutional commitment to addressing resilience, from the director to the newest volunteer.
- The Watershed Management Group highlighted the importance of being flexible because different K-12 classrooms use different curricula, and it is important to first understand communities' needs and desires.
- The Elizabeth River Project noted that for 4th graders and younger students, climate education should focus on simply appreciating nature, which helps develop stewardship and interest.
- Groundwork Hudson Valley, among other projects, attributed some of their successes to knowing their audience, helping students find their voice, keeping students moving, tying

their projects into the curriculum, creating incentives for students, and utilizing partners to achieve project outcomes.

- Brooklyn College highlighted the importance of making a project personally relevant. In New York, schools affected by Hurricane Sandy signed up to participate in their project before funding was even secured because they had seen first-hand the effects of a natural disaster on their community.

Breakout Sessions

During the breakout session, project team members split up into two groups to discuss**:** Engagement Inside the Classroom (i.e., K-12 education) and Engagement Outside the Classroom (i.e., informal education). The objective was to compile participants' thoughts on challenges faced by education projects focused on community resilience, best practices for such projects, and opportunities for growing resilience education. The following day, workshop attendees voted on the best practices, challenges, and opportunities that they thought were most important for a team implementing a resilience-focused project to know. The top five best practices, challenges, and opportunities from each group are listed in Tables 1 and 2 with vote tallies in parentheses, and the full lists with vote tallies can be found in Appendix D.

Engagement Inside the Classroom

Participants in the K-12 education breakout groups discussed challenges, best practices, and opportunities when working with students and teachers in classrooms. There was some overlap between the informal and K-12 groups, as many efforts regardless of audience face similar issues. Often, challenges were also seen as opportunities, and many of these are difficult to implement, sometimes beyond the control of the organizations themselves and more reflective of general challenges associated with working in the formal education environment.

Table 1: Top 5 Challenges, Best Practices, and Opportunities Inside the Classroom

Challenges	Best Practices	Opportunities
Funding issues (6)	Creating a sense of place (8)	Support direct student interaction with scientists, city planners, and community members of different generations(11)
Hard to reach the hard to reach (5)	Teacher training (6)	Citizen science as an opportunity to begin discussions about resilient solutions (9)
How do we define "resilience"? (5)	Co-creating with other groups (6)	Get students outdoors (8)
Professional Development (4)	Building on strengths of programs and people (4)	Have students identify issues affecting their schools and implement solutions (8)
Equity issues in activities (4)	Support network of teachers (4)	Multidisciplinary resilience education (8)

Challenges

Participants brought up over 40 challenges when working with K-12 students and teachers in resilience education. Challenges fell into 16 different categories, such as the issue of apathy, working with state/local education systems, resources, and incentives. Apathy included mentions of students feeling like they cannot make a difference and the difficulty of making learning about resiliency "fun." The topic of resources included: lack of materials, poor or no internet, inaccessible computers, or various web content blocked at the school.

Many of the challenges fostered multi-layered discussion. For example, "Professional Development" challenges included: 1) determining what changes are needed to support professional development; 2) re-thinking incentives; 3) ensuring professional development opportunities are accessible to teachers who serve vulnerable students; and 4) sustainability of professional development.

Best Practices

For best practices, participants mentioned 25 methods for engagement inside the classroom. The best practices loosely fall into 4 different topics—teaching styles, supporting participants, messages, and resources. The top choices—creating sense of place, teacher training, co-creating with other groups, building on strengths of programs and people, and a support network of teachers—each cover these 4 different categories.

"Teaching styles" was the largest category, with 11 best practices, as people discussed different education practices, such as project-based learning and choice-based learning. They also mentioned different best practices for educating about resilience, such as using visuals and audio, creating strong analogies, using elements of surprise, incorporating everyday objects to explain issues, and creating a curriculum that educators can edit in real-time. Participants also highlighted the importance of supporting the participants through stipends for teachers, publically recognizing schools for their efforts, creating incentives or motivations for students, and creating a network of teachers where they can share their work. Resources varied from open access and shareable online resources to utilizing experts and having reliable points of contact in the schools.

These best practices emphasized the need to work together to achieve the best results, with each other, within the schools, and other partners. This theme was apparent throughout the workshop and was the purpose of the workshop itself—to collaborate together, learn from each other, and understand how resilience education can best be used. In her talk on Engaging Youth and Adults about Climate Change and Resiliency, keynote speaker, Cara Pike of Climate Access, also highlighted the need to create a sense of excitement, so youth can work towards climate resilient solutions.

Many of the best practices overlapped with opportunities, such as "multidisciplinary education", as well as certain challenges, such as creating incentives and having enough resources. As seen in the following section, many of these best practices can also be applied for engaging outside the classroom.

Opportunities

The breakout sessions identified 23 opportunities for engaging K-12 students and educators. Topics fell into five categories: 1) outdoor education, 2) citizen science, 3) relevance, 4) sharing/communication, and 5) multidisciplinary education. Related to citizen science, for example, people discussed the importance of not treating citizen science as data collection only, but also as an opportunity to begin discussions about resilient communities. Topics also centered around the importance of capturing student experiences of any citizen science activities, and using this work to make connections to policy and social justice issues. Participants emphasized bringing students outdoors, and to partner with outdoor education nonprofits to help develop resilience education programs. In terms of "relevance", participants highlighted the usefulness of finding scalable ways to support direct student interaction with scientists, city planners, and community members in different generations. Other ways to make their resilience projects relevant included finding ways to connect resilience education to Next Generation Science Standards (NGSS); helping schools implement relevant activities; creating professional development opportunities for school administrators; and creating incentives or prizes to recognize student work in resilience.

Resilience education also creates opportunities to share and communicate resilience issues and programs. For example, participants hope to create more virtual and in-person opportunities for students to share their projects with the public, their family, their peers, and other students across the country. They also would like to see a digital space, such as through social media or TV, where students can share with each other, as well as a summit for teachers to share with teachers. Lastly, multidisciplinary education was a key focus during this breakout group. This implies including resilience topics in non-science classrooms, such as art and social studies. By reaching out to a variety of classrooms, disciplines, and learning styles, these programs have the opportunity to reach as many students as possible and create lasting change.

Engagement Outside the Classroom

Participants in the informal education breakout groups discussed challenges, best practices, and opportunities when working with general audiences, often in a museum-type setting. As noted above, K-12 and informal groups noted many of the same problems. Additionally, it was noted that many of the best practices can be very difficult to implement and are often identified as challenges.

Table 2: Top 5 Challenges, Best Practices, and Opportunities Outside the Classroom

Challenges	Best Practices	Opportunities
Educating public officials on importance of public engagement (7)	Address values and emotions (13)	Build relationships with scientists, local government, and community organizations (12)
Large amount of NOAA tools and assets (5)	Recognize the importance of the family unit on decision making (10)	Fun events that engage people in an interesting & family setting (9)
Ongoing engagement with participants (5)	Storytelling is more powerful than "raw" data (9)	Citizen science & civic engagement: engaging the unengaged (9)
Different audience than is typical for the organization (4)	Be accessible to your audience (8)	Engaging public audiences at informal education centers (8)
Creating a list of feasible, community-based solutions (4)	Facilitate discussions rather than lecture (7)	Spreading hope with stories, especially via social media (7)

Challenges

Workshop attendees identified 26 challenges facing resilience education projects in engaging with general audiences. Because many of these projects intend to work with city planners, educating local officials on the importance of public engagement is a key factor for success. However, many people have found it difficult to show officials why resilience education is such an important part of public engagement. Incorporating NOAA assets into education programs is required for all grantee projects, and grantees find them helpful for accomplishing their goals and objectives, but the large number of assets makes finding the most relevant resources a difficult challenge.

Grantees have also realized that for resilience education to truly work, it requires ongoing engagement with the audience. A one-time message to a museum visitor is not enough to create resilient citizens and communities, and the target audience for resilience education is often different than the audiences that the organizations typically attract, so following up with them can be particularly hard. Following up is a challenging aspect of many projects, but it is also considered a best practice and critical to a successful project. Finally, people respond best to actual solutions, but creating a tangible list of community-based solutions that people can participate in can be extremely difficult.

Best Practices

The breakout groups identified 26 best practices being used in their projects. The best practices fell into three general categories: 1) preparing and planning of projects, 2) how to be relevant to the audience, and 3) interacting with the audience.

The most popular best practices—addressing values and emotions, recognizing that the family unit is a major influencer on how people think, and using storytelling rather than raw data—all focus on the importance of making the issue personal and relevant to the audience. This was a

major theme throughout the workshop, but it is also considered a major challenge. Many participants discussed how raw data, graphs, and charts can be useful, but ultimately, people become most engaged and ready to act when they feel emotionally invested in the topic and begin to understand how their everyday lives will be affected.

Many best practices focused on how to interact with your audience. Facilitating discussions and listening to concerns, rather than lecturing, were considered key factors in successful engagement. It is important to recognize that subject matter experts are often outsiders to the community, and the community will know what is best for itself, if given the right information. Successful projects bring people together, increase awareness, and provide the information needed for communities to make informed decisions. Finally, following up with the audience is the only way to successfully build resilient citizens and communities. As previously discussed, a one-time, ten-minute presentation, or even a day-long workshop, is not enough; building resilience requires a sustained, ongoing commitment from both parties. Because audiences are difficult to track after leaving an informal learning center, maintaining engagement is one of the most challenging aspects for many projects. Distributing surveys immediately after a presentation and collecting email addresses for later follow-ups were two suggestions for continuing to engage with an audience.

The final theme of the best practices focused on the preparation and planning stages of projects. These ideas included bringing universities, museums, and non-partisan think-tanks together to brainstorm. Having a diverse set of participants and knowledge was a theme throughout all breakout groups and the entire workshop. In addition, because issues like climate change can be difficult to talk about, and some of the target audiences may already have preconceived ideas, it is important for presenters to roleplay the facilitation of difficult discussions that they may encounter with their audiences. Finally, although the field of resilience education is fairly new, there are already several best practices (listed in this report) that practitioners should learn and apply to their own projects, so they do not waste time reinventing the wheel.

Opportunities

The breakout groups discussed 18 unique opportunities that may arise from their projects and engagement with general audiences. The top vote-getter was the opportunity to hold "fun events" that get people engaged in an interesting setting, especially with their families. This relates to one of the top best practices recognizing the importance of the family unit. Children strongly influence their parents' decisions, and getting entire families involved is a successful strategy to building long-term resiliency. Citizen science is another great opportunity to "engage the unengaged." Grantees reported that people learn better and participate more actively when they know that they are part of the scientific process.

Resilience education projects also present an opportunity for organizations like schools and museums to build stronger relationships with local scientists, government officials, and community organizations like churches. Many of these projects are directly tied to a city's resilience plan, and project teams are actively engaging with local planners. Building relationships with scientists in NOAA and academia strengthens the information delivered and ensures that museum presenters are informed and confident (a top challenge for many projects).

Providing feasible, community-based solutions was discussed throughout the workshop as one of the only methods to effectively engage people in resiliency over long time periods. When solutions are not readily identified, many people lose hope and view resiliency as a lost cause, especially when dealing with climate change. These projects have the opportunity to spread hope and solutions through success stories via social media and other forms of communication, which can lead to sustained and meaningful action. Resilience education projects also create opportunities to integrate the arts into scientific learning, provide communication training to scientists, and create new community leaders.

Use of NOAA Assets

The Environmental Literacy Programs requires all projects to utilize NOAA's scientific data, data access tools, data visualizations, and/or other physical and intellectual assets. Projects are strongly encouraged to partner with relevant NOAA offices and programs or employees and affiliates (ELG FFO 2016). This requirement increases the awareness and use of NOAA tools within the audiences reached by the projects and helps to advance NOAA's mission.

During the workshop, participants mentioned how they use NOAA's assets in their projects. For example, the Science Museum of Virginia is incorporating NOAA's measurements of past temperature and carbon dioxide levels into their "NOAA Nook," an art lab where visitors can draw about climate change. They are also planning to use NOAA data and tools in monologues and skits to educate guests on how to access data and information for themselves online. The Gulf of Maine Research Institute uses NOAA's Digital Coast to teach about sea level rise, and The Watershed Management Group has a citizen science component, where students participate in the CoCoRaHS Network, which has been previously funded through ELP, to collect and submit precipitation data. Almost every project reported partnering with NOAA scientists and making use of the Climate Resilience Toolkit.

To help the participants increase their understanding of NOAA assets, the workshop hosted a panel that discussed: 1) NOAA's Digital Coast, 2) NOAA Data in the Classroom, and 3) the U.S. Climate Resilience Toolkit. These are three of the most frequently used and relevant NOAA assets for resilience education projects.

Josh Murphy discussed NOAA's Digital Coast, which brings geospatial data and coastal management communities together online. Constituent-driven, its audience is mostly coastal planners and other related stakeholders, but it is aimed toward the entire coastal management community. Content includes professional training sessions, place-based narratives called "Stories from the Field", and quick links on particular topics. Digital Coast is a popular resource for projects working on sea level rise, storm surge, and coastal flooding.

Dan Pisut highlighted three available modules through NOAA's Data in the Classroom: El Niño, coral bleaching, and sea level. Four additional modules will be available at a later date covering sustainable fisheries, severe weather, water quality, and ocean acidification. Data in the Classroom provides a scaffolded approach to bringing NOAA's real-time data into the classroom so that knowledge learned in one step can be applied in the next one.

Frank Niepold explained the U.S. Climate Resilience Toolkit and how it helps build resilience and can simplify complex topics based on the audience's needs. The toolkit is designed to help communities and businesses build resilience to extreme weather and climate events. Engagement with communities is a critical piece of the toolkit, and there are efforts underway to capture ongoing local initiatives and create relevant, community-based case studies.

There was a broad discussion of challenges that users of these resources face when attempting to use them in an education setting. Some difficulties expressed were: "too many technical difficulties," "overwhelming" data, inability to use the resources in an offline environment, and a

lack of regionally relevant datasets. Suggestions included a helpline for support, narratives that show how data is being used, additional tutorials to help people learn about best practices, and a curated list of online resources.

Working with Resilience Planners

On Day 2 of the workshop, there was a facilitated discussion among a panel of city and state officials on the role that education plays in community resilience and the disconnect between resilience planning efforts and the communities' knowledge of and engagement with resilience efforts. The panelists were:

- Austin Blackmon, Chief of Environment, Energy, and Open Space, City of Boston
- John Bolduc, Environmental Planner Community Development, City of Cambridge
- Julia Knisel, Coastal Shoreline and Floodplain Manager, Massachusetts Office of Coastal Zone Management

A main goal of resilience education work is to provide communities and individuals with the knowledge and information needed to make informed decisions and engage with local efforts. Resilience planners can be an integral part of resilience education by helping people understand why certain public policies are in effect and by aiding communities in being more proactive in protecting themselves and their property. However, planners need to be informed of the impacts that communities are experiencing in order to create good policy.

Resilience planners experience many of the same challenges when interacting with the public that the workshop attendees identified in their projects. Planning efforts can seem far off in the future, and it is difficult to create a sense of urgency regarding the risks. Scientific and modeling data can be hard to understand, but community members become most engaged when they witness first-hand extreme events or how resilience planning prevented a hazard. Showing community members examples of how planning prevented, or would have prevented, a local hazard is a very effective strategy for increasing engagement and participation in the planning process.

When working with resilience planners, the panelists reminded the grantees to be genuine when asking for assistance or partnerships by showing that they care about the issues and that they value what the planners have to say. City planning is a long-term issue so planners need to know how long project teams are committed to working with them. In addition, budgets are always tight and it is difficult to make financial commitments. Often, city planners and resilience projects have similar goals, but education projects via classroom or museum connections can reach a wider audience and convene groups that city planners cannot normally reach. This engagement can lead to collaborative partnerships that assist the city in their efforts to reach those audiences.

Next Steps and Opportunities for Collaboration

At the end of the two-day workshop, all participants discussed next steps. There was broad interest expressed in continuing to collaborate with each other and sharing additional resources and approaches. Recommendations were: 1) to list all projects with links to their websites and the best practices they are using; 2) to share among current and potential grantees a summary of NOAA and other tools and how they are being used in current projects; 3) to establish an online community (e.g., Google site or Facebook page) to continue collaboration/sharing among projects; and 4) to collaborate with others in similar geographical areas. These next steps would ensure the future sharing of resources and best practices, such as recruiting a diverse set of participants and knowledge.

There was an open discussion of collaboration ideas and similar approaches being used across projects. Of the many ideas discussed, the following had relevance for several projects. Opportunities for further collaboration were noted among projects working in informal education and with libraries. Training materials developed for informal educators may work for librarians and vice versa. For example, Califa created an online professional development opportunity for librarians, and the booklist created for the PLACE project could be transferable to informal education. Libraries could also use the Visualizing Change toolkit.

There was a good deal of discussion about effective engagement of participants in resilience activities. The grantees suggested collaborating on ideas for leadership development of children and youth and approaches for hosting youth climate resilience summits. A question was raised about how to assess if students are becoming climate literate. This is potentially an area where NOAA could identify and share outside expertise. Currently, the Science Museum of Virginia and Groundwork Hudson Valley may have assessment measures to share. In addition, Climate Literacy and Energy Awareness Network (CLEAN) members have already developed climate literacy assessment tools. Beyond the engagement of children and youth, the group discussed how best to engage other organizations, other than city planners, working in resilience and to share best practices for recruiting and maintaining the "right" community participants. There was interest in sharing approaches for maintaining involvement in local resilience efforts of participants beyond the activities of the grant-funded project—a key challenge noted earlier in the workshop.

Many grantees also hope to demonstrate successful integration of art in their programs, as the Elizabeth River Project and the Science Museum of Virginia have done. The American Geophysical Union also has an active community looking at the intersection of geoscience and art, providing another avenue for learning and sharing about these activities.

Science centers, aquariums, and museums are exploring how they can work together to leverage the public's trust in informal science education institutions, which enables them to serve as community catalysts or anchors to convene conversations about resiliency.

Additionally, many grantees wanted to emphasize the need to share best practices on building systems thinking into their programs. Potential sources of information and resources named

include: SERC-Carleton's InTeGrate, Children's Environmental Literacy Foundation, Cloud Institute, Shelburne Farms, Center for Ecoliteracy in California, the Waters Foundation, Walton Sustainability Solutions Initiative at ASU, Climate Interactive out of MIT, CLEAN and MetaMap. Participants also expressed interest in exploring how data and geospatial literacy help in resilience planning or decision-making. Several projects plan to share lessons and tools for community action projects and vulnerability assessments by K-12 audiences.

Cultivating this community of practice is essential, and as a brand new field, resilience education has many challenges and opportunities. In a post-workshop survey, over 94% of the participants stated that this workshop was helpful for improving the effectiveness of their work with resilience education. The workshop provided a chance to discover new ideas, meet new people and improve knowledge of best practices and solutions to challenges. This workshop has paved the way for increased collaboration among the grantees, with grantee-driven webinars and the creation of an online community underway. NOAA will continue to foster relationships with and among its internal and external partners in order to strengthen the grantees' work on resilience education. Additionally, NOAA will work to advance the field of resilience education by ensuring their grantees' work is shared with a broader audience who may benefit from their lessons learned, best practices, and resilience education models.

Appendices

Appendix A: Participants

Institution	Project	Name
Califa	PLACE	Paula MacKinnon
Dominican University	PLACE	Karen Brown
Museum of Science, Boston	Science Center Public Forums	David Sittenfeld
Museum of Science, Boston	Science Center Public Forums	Emily Hostetler
Arizona State University	Science Center Public Forums	Mahmud Farooque
Arizona State University	Science Center Public Forums	Nicholas Weller
Groundwork Hudson Valley	Global, Local, Coastal	Victoria Garufi
Groundwork Hudson Valley	Global, Local, Coastal	Perry F. Dripps
Groundwork Hudson Valley	Global, Local, Coastal	Ellen Theg
Groundwork Hudson Valley	Global, Local, Coastal	Jennifer Sloan
Gulf of Maine Research Institute	C-RISE	Leigh Peake
Gulf of Maine Research Institute	C-RISE	Jonathan Labaree
Gulf of Maine Research Institute	C-RISE	Gayle Bowness
Nisqually River Foundation	From Mt. Rainier to the Pacific Coast	Sheila Wilson
Thurston Conservation District	From Mt. Rainier to the Pacific Coast	Stephanie Bishop
Science Museum of Virginia	Learn, Prepare, Act	Eugene Maurakis

Science Museum of Virginia	Learn, Prepare, Act	Jeremy Hoffman
Science Museum of Virginia	Learn, Prepare, Act	Kimberly Jones-Clark
Science Museum of Virginia	Learn, Prepare, Act	Tyler Rhodes
Brooklyn College	RiSC Program	Brett Branco
NYC Eco-Schools Program	RiSC Program	Emily Fano
Resilient Schools Consortium	RiSC Program	Andrew Zimmerman
NYC Department of Education	RiSC Program	Lynn Shonn
Elizabeth River Project	Preparing Norfolk Area Students for America's Second Highest Sea Level Rise	Robin Dunbar
Maritime Aquarium at Norwalk	Sound Resilience	Tom Naiman
Maritime Aquarium at Norwalk	Sound Resilience	Avalon Bunge
Museum of Science and Industry	Teen Advocates for Community and Environmental Sustainability	Bryan Wunar
Museum of Science and Industry	Teen Advocates for Community and Environmental Sustainability	Marvin McClure
Museum of Science and Industry	Teen Advocates for Community and Environmental Sustainability	Charles Brass
Watershed Management Group	Recharge the Rain	Catlow Shipek
Watershed Management Group	Recharge the Rain	Kerry Schwartz
Watershed Management Group	Recharge the Rain	Betsy Wilkening
The Wild Center	Convening Young Leaders for Climate Resilience in New York State	Jen Kretser

The Wild Center	Convening Young Leaders for Climate Resilience in New York State	Stephanie Ratcliffe
New England Aquarium	Community Partnership for Resilience	Billy Spitzer
New England Aquarium	Community Partnership for Resilience	John Anderson
New England Aquarium	Community Partnership for Resilience	Rebekah Stendahl
NOAA Office of Coastal Management		Josh Murphy
NOAA Greater Atlantic Fisheries Office		Colleen Coogan
NOAA Office of Coastal Management		Adam Stein
NOAA Grants Management Division		Nicola Bell
Waquoit Bay National Estuarine Research Reserve		Joan Muller
NOAA NESDIS		Dan Pisut
NOAA's Climate Program Office		Frank Niepold
NOAA Office of Education		Carrie McDougall
NOAA Office of Education		Christos Michalopoulos
NOAA Office of Education		Louisa Koch
NOAA Office of Education		Maggie Allen
NOAA Office of Education		Patrick Drupp
NOAA Office of Education		Bronwen Dumais
NOAA Office of Education		Jaime Frungillo

NOAA Office of Education	Sarah Schoedinger
NOAA Office of Education	Christopher Nelson
NOAA Office of Education	John McLaughlin
Climate Access	Cara Pike

Appendix B: Agenda

Day 1 - Wednesday, September 13th

TIME	SESSION
8:30-9:00am	**Check In** (coffee/tea provided) Please check in at the registration table located in the lobby of the Museum of Science. Participants will be escorted to the Skyline Room. *Note: All sessions occur in the Skyline Room unless indicated otherwise.*
9:00-9:30am	**Introduction and Welcoming Remarks** *Carrie McDougall, Senior Program Manager, NOAA Office of Education* *Sarah Schoedinger, Senior Program Manager, NOAA Office of Education* *David Sittenfeld, Program Manager, Museum of Science, Boston* *Louisa Koch, Director of Education, NOAA*
9:30-10:20am	**Project Overviews Round 1** Project teams introduce their programs and themselves in a "lightning round" of presentations. *Jeremy Hoffman, Climate and Earth Scientist, Science Museum of Virginia* *Tom Naiman, Director of Education, Maritime Aquarium of Norwalk* *David Sittenfeld, Program Manager, Museum of Science, Boston* *Bryan Wunar, Director of Community Initiatives, Museum of Science and Industry* *Sheila Wilson, Program Director, Nisqually River Foundation* *Betsy Wilkening, Education Coordinator, Watershed Management Group*
10:20-10:50am	**Break** (snacks, coffee/tea provided)
10:50-12:30pm	**NOAA and Other Federal Resources: What Works and What Doesn't Work?** A panel presentation of resilience-related resources (Digital Coast, Data in the Classroom and Climate Resilience Toolkit) followed by Q&A. Grantees will also share how they are integrating the resource(s) into their projects and provide feedback on these resources. *Joshua Murphy* *Dan Pisut, Program Manager, NOAA Visualization Lab* *Frank Niepold, Climate Education Coordinator, NOAA Climate Program Office*
12:30-1:30pm	**Lunch** (provided) **and Sign-up for Afternoon Break-out Sessions**
1:30-2:30pm	**Museum of Science Activity** Learn and explore the Museum of Science Exhibit, the Yawkey Gallery on the Charles River. *Note: We will begin this session in the Skyline Room.* *David Sittenfeld, Program Manager, Museum of Science, Boston* *Emily O'Hara, Exhibit Developer, Museum of Science, Boston*
2:30-3:30pm	**Engaging Youth & Adults about Climate Change and Resiliency** This interactive keynote address will explore barriers and opportunities in climate communication with a focus on engaging youth in better understanding the risks of climate change and being part of solutions. The session will highlight framing and

	outreach best practices and provide opportunities to apply key takeaways. *Cara Pike, Executive Director, Climate Access*
3:30-3:45pm	**Break** (snacks, coffee/tea provided)
3:45-4:55pm	**Challenges, Best Practices, and Opportunities for Resilience Education** Smaller group discussions to gather grantee's thoughts on the challenges faced by education projects focused on community resilience, best practices for such projects, and opportunities to expand such efforts in the future. Locations: Educator Resource Center and Skyline Room; room assignments will be determined after lunchtime sign-up. You can participate in one of two "themes": *Theme 1: Engagement Outside the Classroom* This theme will focus on efforts that engage general audiences. Specifically, how can projects best engage broad cross-sections of communities? *Theme 2: Engagement Inside the K-12 Classroom* This theme will focus on efforts that engage K-12 student and teacher audiences. This can include discussions of curriculum, lesson plans, instructional materials, etc.
4:55-5:00pm	**Wrap-up of Day 1**
5:00pm	**Adjourn**
5:00-7:00pm	Optional: **Happy Hour** Location: Royal Sonesta Art Bar (if it's nice out) or Lingo

Day 2 - Thursday, September 14th

Time	Session
8:30-8:45am	**Check In** (coffee/tea provided)
8:45-9:00 am	**Recap of Day 1 and Announcements**
9:00-9:50am	**Project Overviews Round 2** Project teams introduce their programs and themselves in a "lightning round" of presentations. *Gayle Bowness, Science Education Program Manager, Gulf of Maine Research Inst.* *Robin Dunbar, Deputy Director - Education, Elizabeth River Project* *Brett F. Branco, Professor, Brooklyn College* *Karen Brown, Professor, Dominican University* *Jennifer Sloan, Director of Education, Groundwork Hudson Valley* *Rebekah Stendahl, Director of Programs, New England Aquarium* *Jen Kretser, Director of Programs, The Wild Center*
9:50-10:00am	**Break**
10:00-11:00am	**Engaging Public Officials in City and State Governments** A facilitated discussion among a panel of city and state officials on the role education plays in community resilience and the disconnects that exist between their resilience

	planning efforts and the communities' knowledge of and engagement with resilience efforts. Learn how education can integrate with these resilience efforts. *Austin Blackmon, Chief of Environment, Energy, and Open Space, City of Boston* *John Bolduc, Environmental Planner Community Development, City of Cambridge* *Julia Knisel, Coastal Shoreline and Floodplain Manager, MA Office of Coastal Zone Management*
11:00-11:30am	**Break** (snacks, coffee/tea provided)
11:30-12:30pm	**Strategies for Engaging Public Officials in City and State Governments** Q&A with the panel of city and state government officials followed by a facilitated group discussion about strategies for and lessons learned from engaging public officials in city and state governments.
12:30-1:30pm	**Lunch** (provided)
1:30-2:45pm	**Project Outcomes and Promoting Your Work** A discussion among NOAA's Environmental Literacy Program (ELP) Grants Team and grantees about general grants management issues, as well as how the ELP grants team uses your project's outputs and outcomes to track and promote your progress and lessons learned. We will also discuss ideas for dissemination of project results and possible scale-up. *NOAA Office of Education*
2:45-3:05pm	**Break** (snacks, coffee/tea provided)
3:05-3:15pm	**Science Museum of Virginia Climate Change and Resiliency Skit** The Science Museum of Virginia uses skits as introductions, quirky interludes, and suspense building action in their Science On the Sphere Theater, and before and during special events. Kimberly Jones-Clark and Jeremy Hoffman will perform the skit, "Sneeze Science Sonata." *Kimberly Jones-Clark, Resident Actor/Writer, Science Museum of Virginia* *Jeremy Hoffman, Climate and Earth Scientist, Science Museum of Virginia*
3:15-4:15pm	**Wrap-up Discussion and Potential Areas for Collaboration** A group discussion to identify project overlaps, potential areas of and tools for collaboration among projects and with other programs. *NOAA Office of Education*
4:15-4:30pm	**Concluding Remarks** *Christos Michalopoulos, Deputy Director of K-12 & Informal Education, NOAA* *Carrie McDougall, Senior Program Manager, NOAA Office of Education* *Sarah Schoedinger, Senior Program Manager, NOAA Office of Education*
4:30pm	**Adjourn**
7:00-9:00pm	Optional: **New England Aquarium Fall Lecture Series: Extreme Events and Climate Change: What We Know and What We Can Do** Location: Simons IMAX Theatre New England Aquarium *Ellen Marie Douglas, PE, PhD, Associate Professor of Hydrology, UMass Boston* Ellen Marie Douglas will discuss observations of our changing climate, what changes may be in Boston's future, and some plans for how to adapt to these changes.

Appendix C: Projects, Institutions, and Abstracts

Institution: Califa
Title: Public Libraries Advancing Community Engagement: Environmental Literacy Through Climate Change Discussions (PLACE)
Public Libraries Advancing Community Engagement: Environmental Literacy Through Climate Change Discussions (PLACE) is a nationally disseminated, locally-based program that engages adults in geographic-specific discussions and critical thinking about resilient responses to environmental changes and extreme weather events, through programs in their local public libraries. Historically, opportunities to increase adults' environmental literacy have typically been available only through established science centers, and/or tended to target citizens who are already interested in environmental topics and issues. While science center hosted events and exhibits are important, reaching new and underserved audiences is imperative. PLACE engages new audiences—in their own libraries and with their own communities — by discussing their challenges, threats and helping their communities prepare for and respond to climate change and extreme weather events. PLACE will help rural and under-resourced communities build resilience to their region's' unique vulnerabilities and threats through the following: (1) Select 50 rural and under-resourced libraries across the United States, (2) Create environmental literacy materials for library programs and professional development materials for librarians, (3) Provide professional development to participating librarians, developing their environmental literacy and fostering the use of NOAA assets for library patron services, (4) Assist libraries in finding and partnering with NOAA scientists, (5) Support libraries implementing a three-part, environmental literacy book/video/discussion program series for adults, complemented by a curated collection of NOAA assets that align with each program's topic, and (6) Perform a summative evaluation of the impact and outcomes of the program. The project has a sustainability plan and a network in place to support the activities in an ongoing, national model for years beyond the initial project funding. PLACE leverages the model and resources of an earlier, similar program, Pushing the Limits (funded by the National Science Foundation), which demonstrated significant success in raising adults' general science literacy in rural libraries across the United States. The project is being created, disseminated and evaluated through a partnership of The Califa Group (a California library consortium) and the National Weather Service, working in tandem with NOAA's Office of Education.

Institution: Consortium for Science, Policy and Outcomes
Title: Science Center Public Forums: Community Engagement for Environmental Literacy, Improved Resilience, and Decision-Making
By engaging diverse publics in immersive and deliberative learning forums, this three-year project will use NOAA data and expertise to strengthen community resilience and decision-making around a variety of climate and weather-related hazards across the United States. Led by Arizona State University's Consortium for Science, Policy, & Outcomes and the Museum of Science Boston, the project will develop citizen forums hosted by regional science centers to create a new, replicable model for learning and engagement. These forums, to be hosted initially in Boston and Phoenix and then expanded to an additional six sites around the U.S., will facilitate public deliberation on real-world issues of concern to local communities, including rising sea levels, extreme precipitation, heat waves, and drought. The forums will identify and clarify citizen values and perspectives while creating stakeholder networks in support of local resilience measures. The forum materials developed in collaboration with NOAA will foster better understanding of environmental changes and best practices for improving community resiliency, and will create a suite of materials and case studies adaptable for use by science centers, teachers, and students. With regional science centers bringing together the public, scientific experts, and local officials, the project will create resilience-centered partnerships and a framework for learning and engagement that can be replicated nationwide.

Institution: Groundwork Hudson Valley;
Title: Global, Local, Coastal: Preparing The Next Generation for A Changing Planet
This project, "Global, Local, Coastal", will be led by Groundwork Hudson Valley and Sarah Lawrence College, to integrate and expand the work of three award-winning environmental education centers in Yonkers, NY – The Science Barge, Ecohouse and the Center for the Urban River (CURB). Its primary objective is to prepare low-income students for the impact of a changing climate so that they can participate both personally and professionally in a world in which these issues are increasingly prevalent. It reaches an audience that is not well served by traditional programs and is most vulnerable to the consequences of climate change. Over the course of two years, the project will serve 600-700 middle and high school youth, primarily from the Yonkers public school system, through a new, integrated curriculum that teaches about these issues from multiple perspectives. Beyond its impact on students, the project will have a broader impact on people in our region. Together, the Barge, Ecohouse and CURB are visited by close to 10,000 people each year and new exhibits will reinforce key themes related to resiliency and adaptation. Other partners include NOAA's Hudson River National Estuarine Research Reserve, Lamont Doherty, and the Center for Climate Change in the Urban Northeast. The state's NY Rising Program and Yonkers Public Schools are key partners too. The project will be carried out in a community that has been severely affected by extreme weather in the last decade, including three hurricanes. Outcomes will help create "an informed society to anticipate and respond to climate and its impacts." It also addresses NOAA's goal of a "Weather-Ready Nation," and "Resilient Coastal Communities and Economies.

Institution: Gulf of Maine Research Institute
Title: Community Resiliency Informed by Science and Experience (C-RISE)
C-RISE will create a replicable, customizable model for supporting citizen engagement with scientific data and reasoning to increase community resiliency under conditions of sea level rise and storm surge. Working with NOAA partners, we will design, pilot, and deliver interactive digital learning experiences that use the best available NOAA data and tools to engage participants in the interdependence of humans and the environment, the cycles of observation and experiment that advance science knowledge, and predicted changes for sea level and storm frequency. These scientific concepts and principles will be brought to human scale through real-world planning challenges developed with our city and government partners in Portland and South Portland, Maine. Over the course of the project, thousands of citizens from nearby neighborhoods and middle school students from across Maine's sixteen counties, will engage with scientific data and forecasts specific to Portland Harbor—Maine's largest seaport and the second largest oil port on the east coast. Interactive learning experiences for both audiences will be delivered through GMRI's Cohen Center for Interactive Learning—a state-of-the-art exhibit space—in the context of facilitated conversations designed to emphasize how scientific reasoning is an essential tool for addressing real and pressing community and environmental issues. The learning experiences will also be available through a public web portal, giving all area residents access to the data and forecasts. The C-RISE web portal will be available to other coastal communities with guidance for loading locally relevant NOAA data into the learning experience. An accompanying guide will support community leaders and educators to embed the interactive learning experiences effectively into community conversations around resiliency. This project is aligned with NOAA's Education Strategic Plan 2015-2035 by forwarding environmental literacy and using emerging technologies.

Institution: Nisqually River Foundation
Title: From Mt. Rainier to the Pacific Coast: Fostering Resilient Climate Leaders, Communities and Coastal Ecosystems
The Nisqually River Foundation, with robust community partnerships with the Chehalis Basin Education Consortium (CBEC), South Sound Global Rivers Environmental Education Network (SSG), Capital Region Educational Service District 113, and Mount Rainier Institute, will work with NOAA Fisheries' West Coast Region's Education and Outreach Specialist, Peggy Foreman to implement a new project:

From Mt. Rainier to the Pacific Coast: Fostering Resilient Climate Leaders, Communities and Coastal Ecosystems. The objectives of the project are threefold: host three Summer Teachers Institutes for participating teachers; develop a Climate Resilient Youth Leadership Program for 12-18 year old students; and, produce and implement clearly identified Action Projects for Community Resiliency for the purpose of conserving local ecosystems and increasing resiliency in their communities to extreme weather events and changing climate. The project aims to result in teachers and students who are well versed in their region's geographical threats of receding glaciers, extreme weather/flooding, rising sea levels, alterations of river flow and ocean acidification, and inspire them to make well informed decisions. Ultimately, over three years, 75 teachers and their 1,875 students, and 140 student leaders from the Cascade Range in the east, Nisqually River and Delta in the north, south to Lewis County, and west to the Pacific Ocean in Grays Harbor County will become more engaged in shaping the region's future through increased informed decision making and related direct actions. The project includes an additional collaboration with the Pacific Northwest Climate Leaders web-based social media campaign, which will engage participating teachers and students in becoming more knowledgeable in local, geographical threats. Project participants will also plant 20,000 native trees and shrubs to restore riparian and coastal habitats, decrease carbon footprint through the project's Cool Schools Challenge, and monitor local stream flows, temperatures and water quality, building on a previous U.S. EPA Targeted Watershed Grant. The project will utilize NOAA's assets to provide participating teachers and students with accurate, relevant and timely scientific information. Specifically, the project will use ClimateChangeLIVE, a distance learning website with a education resources. The project will also use the U.S. Climate Resilience Toolkit which provides scientific tools, information, and expertise to help people manage their climate-related risks and opportunities, and improve their resilience to extreme events. The toolkit will be used to provide guidance to identify problems, determine vulnerabilities, investigate options, evaluate risks and costs and take action. NOAA's mission will be supported as teachers and students share their knowledge in their classrooms, with school districts, at community meetings, and through social media.

Institution: Science Museum of Virginia Foundation / Science Museum of Virginia
Title: Learn, Prepare, Act - Resilient Citizens Make Resilient Communities
Over three years beginning in January 2016, the Science Museum of Virginia will launch a new suite of public programming entitled "Learn, Prepare, Act – Resilient Citizens Make Resilient Communities." This project will leverage federally funded investments at the Museum, including a NOAA-funded Science On a Sphere® platform, National Fish and Wildlife-funded Rainkeepers exhibition, and the Department of Energy-funded EcoLab, to develop public programming and digital media messaging to help the general public understand climate change and its impacts on Virginia's communities and give them tools to become resilient to its effects. Home to both the delicate Chesapeake Bay ecosystem and a highly vulnerable national shoreline, Virginia is extremely susceptible to the effects of climate change and extreme weather events. It is vital that citizens across the Commonwealth understand and recognize the current and future impacts that climate variability will have on Virginia's economy, natural environment, and human health so that they will be better prepared to respond. In collaboration with NOAA Chesapeake Bay Office, George Mason University's Center for Climate Change Communication, Virginia Institute for Marine Science, Public Broadcasting Service/National Public Radio affiliates, and Resilient Virginia, the Museum will use data from the National Climatic Data Center and Virginia Coastal Geospatial and Educational Mapping System to develop and deliver new resiliency-themed programming. This will include presentations for Science On a Sphere® and large format digital Dome theaters, 36 audio and video digital media broadcast pieces, two lecture series, community preparedness events, and a Resiliency Checklist and Certification program. This project supports NOAA's mission goals to advance environmental literacy and share its vast knowledge and data with others.

Institution: Maritime Aquarium of Norwalk, Norwalk, CT

Title: Sound Resilience--Get on Board!
The Maritime Aquarium at Norwalk is located at the mouth of the Norwalk River where it flows into Long Island Sound. Its mission is to inspire people to appreciate and protect the Sound and the global environment. Over the past decade, a large percentage of the region's 23 million people living within 50 miles of the Sound were directly affected by severe weather events, providing a timely opportunity to educate students, teachers and the public about community resilience. In a new three-year program, the Maritime Aquarium will deliver education related to environmental hazards, resilience, and the underlying science to schools from ten towns along or near Connecticut's coast, including eight in the Natural Hazards Mitigation Plan Draft 2016-2021 for Southwestern Connecticut. In these towns as in many coastal regions, the most significant environmental threats are related to the nexus of land and water. To reflect that nexus, education will occur both in the classroom and on the water, aboard the Aquarium's hybrid-electric research vessel, Spirit of the Sound. An exhibit featuring NOAA educational assets related to threats and resilience will also build environmental literacy as it engages Aquarium visitors. The project will be supported by an advisory board of local educators, planning and emergency management officials, representatives from Connecticut Sea Grant, the Connecticut Institute for Resilience and Climate Adaptation and the Western Connecticut Council of Governments.

Institution: Museum of Science and Industry
Title: Teen Advocates for Community and Environmental Sustainability
The Museum of Science and Industry, Chicago (MSI) will develop museum-based education resources to engage high school age youth in the exploration of climate literacy and Earth systems science through its Teen ACES (Teen Advocates for Community and Environmental Sustainability) project. As the future leaders who will make decisions about the issues they face in their communities, youth participants will be positioned to act as advocates for establishing resilient communities in the Midwest. The project will utilize a variety of resources, including NOAA Science On a Sphere® (SOS) technology and datasets, Great Lakes and local climate assets from the Midwest Regional Climate Center and Illinois-Indiana Sea Grant, and existing local planning guides to develop museum-based youth programming. Teens will explore environmental hazards including severe weather events and temperature extremes, and consider the impact of the Great Lakes on regional climate. The Chicago Metropolitan Agency for Planning, Resilient Chicago, the Institute of Environmental Sustainability at Loyola University Chicago, and the South Metropolitan Higher Education Consortium will advise on the project to support the integration of municipal resiliency plans and their related adaptation and mitigation measures into the program. Teen participants will share their learning with the Chicago community through interactions with public visitors in the Museum, programs at Chicago Public Library branches, and MSI's teen science program broadcast on Chicago's public access TV station. Teen facilitated experiences will be tailored for SOS® experiences at MSI. The project will revise content for use in 100 after-school science clubs for students from diverse communities across the Chicago area. Further dissemination to three regional science center partners equipped with SOS® technology (Boonshoft Museum of Discovery in Dayton, Ohio; Science Central in Fort Wayne, Indiana; and Hawthorn Hollow in Kenosha, Wisconsin) will build a foundation of knowledge and resources to adapt materials to meet the needs of their communities and consider how their vulnerabilities and resiliency plans may differ from Chicago.

Institution: Watershed Management Group
Title: Recharge the Rain: Community Resilience through STEM Education
Recharge the Rain moves sixth through twelfth grade teachers, students and the public through a continuum from awareness, to knowledge gain, to conceptual understanding, to action; building community resiliency to hazards associated with increased temperatures, drought and flooding in Arizona. Watershed Management Group with Arizona Project WET will utilize NOAA assets and experts from the National Weather Service and Climate Assessment for the Southwest (CLIMAS) to inform citizens and galvanize their commitment to building a community, resilient to the effects of a warming climate. Project activities will be informed by Pima County's hazard mitigation plan and planning tools related to

preparing for and responding to flooding and extreme heat. Starting January 2017, this four-year project will 1) develop curriculum with Tucson-area teachers that incorporates systems-thinking and increases understanding of Earth systems, weather and climate, and the engineering design of rainwater harvesting systems 2) immerse students in a curricular unit that results in the implementation of 8 teacher/student-led schoolyard water harvesting projects, 3) train community docents in water harvesting practices and citizen-science data collection, 4) involve Tucson community members in water harvesting principles through project implementation workshops, special events, and tours, and 5) expand program to incorporate curriculum use in Phoenix-area teachers' classrooms and 6) finalize a replicable model for other communities facing similar threats. Environmental and community resiliency depends upon an informed society to make the best social, economic, and environmental decisions. This idea is not only at the core of NOAA's mission, but is echoed in the programs provided by Watershed Management Group and Arizona Project WET.

Institution: Elizabeth River Project
Title: Preparing Norfolk Area Students for America's Second Highest Sea Level Rise
Children in the Norfolk, Va., area will inherit the second highest sea level rise on the East Coast. In response, the non-profit Elizabeth River Project will prepare one of the first comprehensive youth education programs on climate change resilience on this coast. The Elizabeth River Project, working since 1993 to restore the environmental health of the urban Elizabeth River, will deploy its Dominion Virginia Power Learning Barge, "America's Greenest Vessel," and its new urban park, Paradise Creek Nature Park, to empower 21,000 K-12 students over three years to become informed decision makers and environmental stewards, prepared to adapt to rising seas. The project primarily will reach under-served schools in Norfolk and adjoining Portsmouth, Va. Lead science partner will be Old Dominion University, on the forefront of climate change research. Other partners include the Chrysler Museum of Art, ground zero for street flooding that has become routine in Norfolk. A youth strategy for the Elizabeth River "watershed" or drainage area will be disseminated nationally internationally by the City of Norfolk through its participation as one the Rockefeller Foundation's 100 Resilient Cities. The youth strategy will be used by Norfolk to complement its Norfolk Resilience Strategy, prepared so far with adults in mind.

Institution: Research Foundation of CUNY / Brooklyn College
Title: Resilient Schools Consortium (RiSC) Program
Brooklyn College, working with NWF Eco-Schools USA, will create The Resilient Schools Consortium (RiSC) Program that increases environmental literacy while engaging high school and middle school students in climate resilience planning and practice in New York City (NYC). The City's long-term planning document, OneNYC, sets forth a vision for a resilient city without specifying a role for students or including specific plans for their schools. This project addresses this gap by developing resilience plans for NYC schools and including student voices in the process. Student RiSC teams at NYC public schools in Brooklyn impacted by Hurricane Sandy will utilize a new Climate RiSC Curriculum based on science from the National Climate Assessment and other NOAA resources to explore the vulnerability of their schools and neighborhoods to climate change, variability and extreme weather. The RiSC teams will follow a resilience assessment process modeled after the NOAA Community Resilience Index to develop resilience projects for their schools and neighborhoods. These Students will then present their resilience plans to NYC Department of Education officials and representatives from the NYC's Office of Resilience and Recovery at RiSC Summits coordinated with the Science and Resilience Institute at Jamaica Bay. The RiSC Program and Climate RiSC Curriculum will be integrated into National Wildlife Federation's Eco-Schools USA program and disseminated nationally through the networks of the project partners.

Institution: New England Aquarium
Title: Community Partnership for Resilience
The New England Aquarium, in collaboration with the Metropolitan Area Planning Council, will establish the "Community Partnership for Resilience". This three-year initiative will bring community

leaders and planning experts together with educators and students to use school and afterschool programs as a venue for engaging the public in understanding and planning for resilience to extreme weather events and environmental hazards. Through this project, the New England Aquarium aims to develop a model for community partnerships to enhance the public's knowledge of Earth's climate system, including the climate's influence on the community and vice versa. Community teams comprised of local leaders from three Boston- area communities (Chelsea, Hull, and Lynn, MA) will identify locally relevant resilience issues that would benefit from public involvement. These teams will partner with educators to develop and deliver tailored climate resiliency curricula to at least 240 students in grades 4-8. The teams and educators will facilitate student-led projects to engage their families, peers, and neighbors about community responses to increase resilience.

Institution: The Wild Center
Title: Convening Young Leaders for Climate Resilience in New York State
The Natural History Museum of the Adirondacks, also known as "the Wild Center", in partnership with Cornell Cooperative Extension of Delaware Country, the Kurt Hahn Expeditionary Learning School in Brooklyn, and the Alliance for Climate Education, implements the "Convening Young Leaders for Climate Resilience in New York State" project. This project builds the environmental literacy necessary for community resilience by focusing on understanding climate change impacts in the Adirondacks, Catskills, and New York City, while working to empower high school students and their teachers to make their communities more resilient. This is accomplished through: (1) high school students participating in summits and leadership practicums; (2) high school students communicating about climate change science and resilience through community climate outreach activities; and (3) high school teachers participating in Climate Institutes. This project aligns with New York State's climate resiliency planning efforts through partnerships with the relevant state agencies, and forms a stronger connection between current community resilience initiatives, educators, and youth.

Appendix D: Challenges, Best Practices, and Opportunities Voting Results

Inside the Classroom Challenges

Challenge	Vote Count
Funding issues	6
Hard to reach the hard to reach	5
How do we define "resilience"? (mitigation vs. adaptation)	5
Professional Development	4
Equity issues in classroom and out of school activities	4
Lack of NGSS Materials	2
Knowledge issues with educators	2
Turnover rate	2
Incentives	1
School calendars	1
Stakeholder buy-in	1
Logistics of transportation	1
Lack of focus on local communities	1
A lot to cover without enough time	1
A lot of lessons but lack of units	1
Confidence issues with educators (personal or community)	1
Lack of materials	0
Poor/no internet	0
Computers (access/content blocking)	0
Language issues (ESL, Cultural)	0
Rigid timeline with curriculum	0
Content alignment in curriculum	0
Communication issues with education system	0
Personalized learning issues	0
Logistics of permission	0
Difficult to address "resilience" and "climate change" in NGSS	0
Apathy-how do we make learning fun?	0
Apathy-feels like participants can't make a difference	0
Teaching too much vs too little	0

Partnership issues	0
Skills issues with educators	0
Attrition	0
Sustainability issues	0
Cross-disciplinary issues	0
Meeting needs of participants	0

Inside the Classroom Best Practices

Best Practices	**Vote Count**
Creating sense of place	8
Teacher training	6
Co-creating	6
Building on strengths of existing programs and people	4
Project-based learning	3
A live, changeable curriculum	3
Thinking locally	2
Using elements of surprise	2
Stipends	2
Open access and shareable online resources	1
Challenging students to think about complex issues	1
Creating hopeful, positive messages	1
Multidisciplinary learning	1
Sharing work with other educators	1
Re-examining for gender and cultural biases	1
Creating strong analogies	1
Bringing in experts and NGOs	1
Teaching with visuals and audio	1
Choice-based learning	0
Knowing background of audience	0
Recognizing schools for efforts	0
Using everyday objects to explain issues	0
Point person in school	0
Creating incentives or motivation for students	0

Inside the Classroom Opportunities

Opportunities	Vote Count
Find scalable ways to support direct student interaction with scientists, city planners, and community members in different generations	11
Treat citizen science not as data collection only, but as an opportunity to begin discussions about resilient solutions	9
Get students outdoors	8
Have students identify issues affecting their schools and implementing solutions and study the results of these solutions with ongoing investigation	8
Connect to students in many disciplines, not just science	8
Create more opportunities for students to share with the public, parents, peers, other students in other parts of the country	6
Convene a summit/forum for teachers from different programs to share with/learn from each other	6
Use citizen science to make connections to Policy/policy makers and Social Justice issues	5
Professional development for school administrators and their priorities	4
Resilience challenge, prize, or other incentive/recognition for student work in resilience (and opportunity to connect to policymakers/decision-makers)	4
Use student work to communicate about resilience issues through TV or social media	4
Ensure resilience programs are relevant to student and teacher audiences	3
Create a digital space to facilitate students sharing with each other	3
Include art in resilience education activities	3
Partner with outdoor education nonprofits to help develop resilience education programs	2
Make teachers' jobs easier by finding ways to connect resilience education to standards/NGSS	2
Help schools implement resilience plans/activities (rain gardens, composting, renewable energy)	2
Climate simulation activities	2
Capture student experiences/reflections in addition to citizen science data	1
Funding/resources dedicated to implementation of resilience projects that students come up with	1
Connect students to employment/volunteer opportunities to build skills related to resilience activities	1
Reaching K-12 youth outside of formal K-12 setting, e.g 4-H, scouts, after school	1
Sharing best practices/lessons learned between resilience programs	1

Challenges Outside the Classroom

Challenges	Vote count
Educating public officials on importance of public engagement	7
Large amount of NOAA tools	5
Resilience education requires ongoing engagement	5
Audience is often different than the organization’s main audience	4
Creating a list of community-based solutions that people can participate in	4
Recruiting low income and low educated audiences	3
Making partners within the community	3
Making content understandable and tangible	2
Technical capacity to use the tools provided by NOAA	2
Getting the right venue/event for the right audience	1
Engagement with participants during and after the project	1
Absenteeism - making sure those that signed up to participate are participating	1
Competing for attention with people’s daily needs	1
Education presenters in climate science to be confident and knowledgeable	1
Shifting cultures	1
Making connection between immediate and long-term concerns	1
Making it relevant and compelling	0
Providing content suitable for multiple ages within one audience	0
Enough time with the students to learn the topic	0
Should you pay the people in the community so that they participate?	0
Comfort level of different age groups with technology	0
People are losing their connection with the term “resilience”	0
Hard for the audience to know how to apply what they are being taught	0
Lack of discussion on incentive structures in resilience planning	0
Combatting the idea that "climate change is a rich person’s problem"	0
Language barriers	0

Best Practices Outside the Classroom

Best Practices	Vote Count
Address values and emotions not just knowledge	13
Recognize that the family unit is a major influencer on how people think	10

Storytelling is more powerful than raw data, graphs, charts, etc	9
Be accessible to your audience; have a range of entry points	8
Facilitate discussions rather than lecture audiences	7
Integrate diverse sets of knowledge in your programming	6
Take Time to build relationships with your audience	5
Get universities, museums, and non-partisan think tanks working together	4
Listen and learn; recognize that you are an outsider to the community	4
Make it personal	3
Identify what is already known and be aware of best practices in the field	3
Focus on solutions	2
During the planning phase, roleplay facilitating difficult discussions that might occur	2
Utilize place-based education	1
Rely on social science	1
Be careful with word choice - scientific vs general meaning (e.g., error, uncertainty)	1
Follow up with your audience - be proactive about it	1
Train people in pairs or more; send people to workshops together	0
Have multiparty teams collaborate with other organizations	0
Get audience feedback	0
Understand your audience - Why are they there?	0
Use citizen science to engage people	0
Consider the timing of your info (e.g., where are students in the school year)	0
Present clear, concise, and relevant info	0
Use members of the target audience in your planning	0
Make it fun	0

Opportunities Outside the Classroom

Opportunities	**Vote Count**
Build relationships with scientists, local governments, and community orgs	12
Fun events that get people to engage in an interesting + family setting	9
Citizen science + civic engagement, engaging the unengaged	9
Informal Education Centers	8
Spreading hope and solutions through stories on social media	7
Learn from diverse communities that are already doing work on resilience	5

Use new technologies	3
Youth leaders learn by teaching or acting as ambassadors	3
STEAM/adding in arts + making sure it’s scientifically correct	2
Providing effective communication training to scientists	2
Engage adults and create more adult programming	2
Help people become community leaders on resilience	1
Leverage current events to explain what's happening in the world	0
Use educational tools for decision making	0
Service learning	0
Get people outside in their community	0
Celebrate small wins	0
Ty cost savings from a project into a community event to celebrate positive incentives for stakeholders	0

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