NOAA Environmental Literacy Program
2019 Resilience Education Grantee Workshop

Report of a Workshop Convened by the NOAA Office of Education
April 29 through May 1, 2019
at the NOAA Science Center, Silver Spring, Maryland

Sponsors:
NOAA Office of Education and the
North American Association for Environmental Education

Credit: Stephen Zepecki (NOAA Office of Education)

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Introduction

Acknowledgements

Support for the workshop was provided by the NOAA Office of Education and the North American Association of Environmental Education.

This report was written by Genie Bey and Maggie Allen of NOAA's Office of Education in consultation with the Environmental Literacy Program team members Jaime Frungillo, Carrie McDougall, John McLaughlin, Christopher Nelson, and Sarah Schoedinger.[1]

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Finally, this event would not have been possible without all of the passionate resilience grantees who joined us in Silver Spring from across the country for three days of shared learning. We appreciate your ongoing efforts to increase community resilience through education. Thank you for participating, and we look forward to continuing this important work with you.

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Background

From April 29 through May 1, 2019, NOAA Office of Education held the second Environmental Literacy Program Resilience Education Grantee Workshop at the NOAA Science Center in Silver Spring, Maryland. This workshop convened the recipients of the grants awarded from 2015-2018 through the Environmental Literacy Program (ELP) community resilience-focused grant competitions. These grants aim to foster the environmental literacy necessary in the communities they serve to contribute to resilience to extreme weather events and other environmental hazards. This workshop built on findings from the first workshop held in 2017 at the Museum of Science in Boston, Massachusetts.

ELP supports projects that both inspire and educate people to use Earth system science to increase ecosystem stewardship and resilience to extreme weather events and other environmental hazards (NOAA Education Strategic Plan, 2015-2035). Since ELP's inception in 2005, the grants offered through this program have supported both formal (K-12) and informal education initiatives that serve NOAA's mission of science, service, and stewardship (ELG Federal Funding Opportunity, 2017). As outlined in NOAA's Education Strategic Plan, individuals should be equipped with the capacity to comprehend scientific processes, consider uncertainty, and grapple with the myriad of ways in which human and natural systems interact and influence one another (2015-2035). This reasoning lays the foundation for the critical role that education plays to achieve NOAA's mission.

In 2015, the focus of ELP shifted from funding primarily climate change literacy projects to funding projects focused on community resilience. This shift reflects the need to generate a solutions-oriented model for educating, engaging, and empowering citizens to mobilize, mitigate, and adapt to climate and other environmental hazards. Since this change, ELP has funded 22 community resilience education projects across the United States and territories, with projects ranging in scale, geographic scope, and duration of funding. All of these projects utilize NOAA's Resilience Assets, which are physical and intellectual resources that can support community resilience and climate change education. The U.S. Climate Resilience Toolkit is one asset in particular that grant projects find useful, as it offers a step-by-step framework for communities to explore the hazards they face, assess their specific vulnerabilities and risks, consider options, prioritize and plan, and finally take action (U.S. Climate Resilience Toolkit). Project abstracts and funded institutions are listed in Appendix C.

A primary goal of this workshop was to reconvene the group of educators that first met at the 2017 workshop, and to introduce new grantees into the burgeoning community of practice of resilience educators and practitioners that ELP supports. This community of practice serves as a catalyst for sharing information on emerging best practices, challenges, and lessons learned about resilience education through each grant project. Through this group, ELP grantees are able to connect across the wide network of professionals from the many related disciplines that come together to support education for community resilience across the nation.

Workshop Summary

The objectives of this Resilience Education Grantee Workshop were to (1) create a venue for collaboration and information sharing among the grantees, (2) provide a science update from climate and resilience experts at NOAA, (3) provide an overview of and solicit feedback on the development of ELP's Resilience Education Theory of Change, and (4) to inform the content of the next ELP funding solicitation. The workshop was attended by 75 participants representing 36 institutions across the country, including universities, school districts, community colleges, informal education institutions, community-based organizations, and NOAA. Speakers included grantees and invited experts in the field.

Prior to the workshop, ELP grantees indicated the topics they were interested in exploring. The topic that received the highest level of interest was environmental justice in community resilience, followed by how to sustain projects beyond the funding period. The following six topics received equal levels of interest: using NOAA assets in projects, how to address the emotional impact of climate change, using citizen science to advance community resilience, effectively involving local city officials, how resilience education is different from climate change education, and curricula used in resilience education. This input, paired with the insights gained from the 2017 workshop, informed the design and content of the workshop agenda. The workshop themes were:

(1) Intersection of Environmental Justice and Resilient Communities,
(2) Emotional Impact of Climate Change,
(3) Curriculum Used in Resilience Education,
(4) Perspectives on Working with Local Officials,
(5) Citizen Science to Advance Resilience,
(6) Evaluation and Long-Term Outcomes, and
(7) Resilience Education Theory of Change.

These themes were addressed through panels, interactive activities, and smaller group discussions called "breakout" sessions. Each theme had a two-part breakout session, so that participants could engage with multiple workshop themes by attending two different sessions. A full workshop agenda can be found in Appendix B.

In addition to the workshop components listed above, the meeting included a series of presentations tailored to fit the needs and interests of the grantees. Tom DiLiberto, a meteorologist with NOAA's Climate Program Office, gave an engaging presentation using NOAA's Science On a Sphere® about climate change and its impacts. Christopher Nelson from NOAA's Office of Education provided an overview of the ways in which the office tracks impacts from and promotes the work of its grantees. Ariana Sutton-Grier delivered a thought-provoking and informative keynote lecture on nature-based solutions to climate change impacts. The workshop also included an Expo/Share-a-thon in which grantees and NOAA

experts offered interactive, hands-on activities and more detailed information about their projects and programs.

Summaries of the grantee and non-grantee panels, as well as the breakout session discussions are included below, followed by an overview of the Resilience Education Theory of Change, and the major takeaways and next steps for the ELP resilience education community of practice.

2018 Environmental Literacy Grantee Panels

In two separate panels, the grantees funded in 2018 discussed their projects' objectives, intended outcomes, and successes and challenges to date. Although these projects are in the beginning of the work, representatives discussed some of their early successes. For example:

- Jordan Larson of Eco-Works noted that Michigan Sea Grant's project, "Climate Resilience from the Youth Up," has received great initial buy-in from students, who have really enjoyed the science aspect of the program. By focusing on concepts instead of definitions and terms, these environmental issues are tangible.
- Rachel Hogan Carr of Nurture Nature Center stated they have seen great engagement so far from their partners, community leaders, and students. The project was able to kick off their youth team and host a few community events.
- Kristen Wilson Grimes said that the University of Virgin Islands (UVI) has successfully marketed their program, developed a website, and advertised their events. They have worked well with their partners and developed curriculum and evaluation instruments.

The grantees also noted a variety of early challenges, such as:

- Anne Gold of the University of Colorado stated that their team underestimated how long it took to make a curriculum, as they wanted to make sure they were using the best resources. They also said that because some of their participants didn't know the correct definitions of resiliency or adaptation, they had to step back a bit and create a vocabulary game for the students.
- Rochelle Mothokakobo from the Ocean Discovery Institute noted the transition to Next Generation Science Standards (NGSS) was difficult because there was no district-wide curriculum, and it varied school-by-school and unit-by-unit. So they are working on improving staff understanding of the project within the school, while also being mindful of teachers' needs.
- Grimes (UVI) said working with such a large team with so many voices and perspectives could create challenges. It has also been difficult for them to recruit participants and find a local evaluator, as well as distilling potential program content to actual program material and activities.

Workshop Themes

Intersection of Environmental Justice and Resilient Communities

Panel Overview

The opening session on day one featured a panel focused on identifying linkages between environmental justice (EJ) and community resilience. This non-grantee panel was facilitated by Jen Kretser, Director of Programs from the Wild Center, and comprised the following environmental justice advocates: Parisa Norouzi, Executive Director of Empower DC; Kerene Nicole Tayloe, Director of Federal Legislative Affairs for WE ACT for Environmental Justice; and Leslie G. Fields, Director of the Environmental Justice and Community Partnerships division of the Sierra Club. The panelists discussed important aspects of social equity that must be addressed to ensure the needs of all members of a community are met in preparing for the physical, economic, and social impacts of extreme weather events and global change.

Parisa Norouzi touched on some of the major EJ challenges that Empower DC focuses on, which include displacement and housing justice, and equitable access to clean air, water, and green space. Norouzi discussed the "Let Ivy City Breathe" campaign, which was an effort to halt the creation of a bus depot in Ivy City for overflow buses from Union Station, a major transportation hub in Washington DC. The proposed depot was to be built near a historic elementary school for people of color called the Alexander Crummell School, which represents the heart of the Ivy City neighborhood. Empower DC built a community-driven campaign to prevent the bus depot from being built in a community already facing significant air pollution. Empower DC was able to prevent the creation of the proposed depot, and is now working to establish a Civic Association for the neighborhood. This association will be supported through strategic neighborhood leadership in hopes of creating a healthier, more resilient Ivy City. Additionally, Empower DC is working to restore the Crummell School for use as a workforce development and community center. By summarizing some of the campaigns that Empower DC has developed over the years, Parisa was able to demonstrate how the work of EJ community-based organizations intersects with efforts to create more resilient communities.

Kerene Nicole Tayloe described the work done by WE ACT for Environmental Justice in New York City with particular emphasis on the impacts of Superstorm Sandy, which hit New York City in October 2012. From January through July 2015, WE ACT led an intensive, community-driven planning process that convened 400 residents of Harlem and other Northern Manhattan neighborhoods. They hosted seven public workshops and dozens of meetings with partners and city agencies to ensure that poor and working class communities exposed to high levels of environmental threats were engaged in the process of planning for resilience. They

ultimately developed the North Manhattan Climate Action Plan, equipped with policy recommendations and informal local actions aimed at reducing environmental impacts while simultaneously addressing systemic inequality. This work demonstrates the importance of involving all members of a community in resilience planning, especially members who are likely to be most adversely affected by an environmental hazard or extreme weather event.

The phrase "we're not going to make it as a planet if anyone is left behind" was displayed on the projector behind Leslie Fields as she discussed the EJ work done by the Sierra Club. Leslie placed particular emphasis on the importance of community partnerships, and she described the work the Sierra Club is doing to address discrimination and oppression faced by many communities. The Sierra Club has a growing network of regional environmental justice programs, and has worked in New Orleans to help rebuild the city after Hurricane Katrina and in Arizona to help protect lands sacred to the Navajo Nation. Leslie shared a video at the workshop which describes Sierra Club's resilience efforts in New Orleans.

Panel Discussion

Following the panelists' presentations, there was a discussion about how to better integrate principles of EJ into the work being done by ELP grantees. One question from the audience was directed at ways for primarily white organizations to better access underrepresented communities. In response, the panelists explained that targeted outreach is key, it is imperative to provide a safe space to meet, meetings should be held after work hours or on weekends, and there should be a paid translator to reduce potential language barriers. Lastly, the panelists emphasized that organizations should focus on increasing cultural competency, sharing their internship programs with Historically Black Colleges and Universities (HBCUs), and hiring staff from diverse backgrounds.

Breakout Session

One of the breakout sessions on day three of the workshop further examined the intersections of EJ and community resilience. Discussion questions were geared toward the success grantee projects have had in helping facilitate equitable engagement among community members in developing resilience plans and better understanding best practices for doing so. The session also aimed to share ideas for how ELP and the projects it supports can better integrate environmental justice and engage with marginalized community members. Lastly, the session sought to grapple with the ways in which resilience education projects supported by ELP help contribute to broader efforts for social, environmental, and climate justice.

Participants in the EJ and community resilience breakout session expressed shared feelings about the increasing need to address social and EJ issues in their work. Some attendees mentioned that

while justice was not always at the center of their project, it has since become a top priority. Participants demonstrated interest in increasing knowledge and awareness of justice issues within their organizations and communities, and suggested that project teams participate in trainings on issues such as dealing with unconscious bias, institutional racism, or white privilege. Other participants mentioned that partnering with community-based organizations with justice-driven missions, or with faith-based organizations, significantly strengthened their efforts. There was demonstrated interest in furthering relationship building with local community-based organizations, with the hope that by creating these partnerships, grantees can build mutually beneficial projects that advance each organization's mission.

The combination of the environmental justice-focused panel and the conversations had in the breakout sessions brought to light the need and growing desire to further centralize issues of social equity and justice in grantee projects. Many of the grantees expressed interest in including more focus on these issues in future ELP work.

Emotional Impact of Climate Change

Panel Overview

The second panel held on day one comprised grantees and focused, focusing on ways in which the emotional impacts of climate change and other environmental issues arise in their projects. Facilitated by Sarah Schoedinger of NOAA's Office of Education, panelists included Jen Kretser, the Director of Programs at The Wild Center; Robin Dunbar, Deputy Director of Education at the Elizabeth River Project; Bryan Wunar, Director of Community Initiatives at the Museum of Science and Industry (MSI); and Jonathan Labaree, Chief Community Officer at the Gulf of Maine Research Institute (GMRI).

GMRI's project, "Community Resilience Informed by Science and Experience" immersed citizens from the greater Portland area in interactive learning experiences that support their engagement with scientific data and reasoning, as they explored sea level rise, storm surge, and resiliency measures. Over the grant's four-year life cycle, Labaree said that the project has reached over 1,400 participants through 45 programs. Through their evaluation, the team found that a lot of people are talking about and thinking about engaging in sea level rise planning, but there are still a lot of questions that people still have about data, how to actually make an impact, and what their towns are doing. Although the participants have stated they've learned more about sea level rise and are taking more actions, GMRI hopes to better connect the community members with local resilience plans and ultimately provide a more interactive experience that helps participants figure out what the pathways to resilience are.

Since 2016, the Elizabeth River Project's grant, "Preparing Norfolk Area Students for America's Second Highest Sea Level Rise," has educated 21,000 K-12 Students, focusing on restoring the Elizabeth River and creating a resilient community. Service-learning, Dunbar explained, is effective at empowering students to feel like they can make a difference. The project has also created a youth conservation intern corps, which builds a future workforce. Real-world action projects and an annual Youth Resilience Summit give students hope and helps them address sea level rise and other climate hazards. These strategies and associated resources have been incorporated into a document, "Resilient Youth - South Hampton Roads."

The Wild Center's project, "Convening Young Leaders for Climate Resilience in New York State," works with students in the Adirondacks (where the center is located), the Catskills, and an Outward Bound School in New York City. Locations are similar in that they all have underserved populations and are projected to experience extreme climate impacts. The project hopes to increase climate literacy and preparedness planning in high school students through place-based Youth Climate Summits. Through lectures, workshops, and activities, the Summit culminates with student participants writing a Climate Action Plan that can be implemented in their schools,

communities, and regions. Krester said that students have taken away from these projects different ways forward, whether it be writing about it in their newspaper or joining a volunteer movement. These Summits ultimately help students recognize their potential and the importance of their voices. Importantly, they have also shown that, in working with youth audiences, you cannot separate justice issues from climate issues.

Bryan Wunar of MSI, Chicago gave an overview of the project, "Teen ACES." MSI is developing museum-based education resources to engage high school-aged youth in the exploration of Earth system science, climate literacy, and community resiliency. Like the other projects, they are also empowering youth to become advocates for the development of resilient communities. They have implemented this project throughout their after-school, youth development, and summer learning programs, as well as developing and disseminating resources throughout the Chicago area via public libraries and park programs. The teens participating in the project have proposed a stance of "radical optimism," choosing to be hopeful rather than dwell in the doom and gloom of climate change. Because the project encourages the youth to be part of the solution and focuses on their personal passion, the teens can maintain that hope.

Panel Discussion

This panel emphasized the importance of student-driven projects, highlighting that these activities help students understand what they can personally do in their schools and their communities to affect positive change. It helps to give students a role, Dunbar said, and focus on restoration rather than threats. Krester also said that their programs across New York State help the students develop empathy, understanding what it is like to be a student in the Adirondacks or East Flatbush. Team building exercises allow students to hear other people's stories. For example, EJ issues in New York City are starting to resonate with those living upstate.

Working with adults, Labaree pointed out that showing a graph of sea level rise to their audiences did not elicit much emotional response. By allowing people to interact with sea level rise maps and looking at places they care about, people started to absorb this information. They started to feel emotional observing how places they live or love could be underwater in the coming years.

Hope was a strong theme throughout this session. The youth want to be hopeful, and focusing on their passions help them feel empowered to be part of the solution. The projects try to have students focus on the success of their local projects, from building a school garden to a carbon neutral prom. These successes give them the confidence to engage in civic learning and stand in front of their school board or city council. "They applied gentle pressure relentlessly, making slow and steady progress", Wunar said.

Fear is still a prominent emotion, whether a student is hesitant to go on a boat for the first time or facing a seemingly overwhelming problem. Programs can help build confidence to address these concerns one step at a time, from holding a student's hand to step onboard or learning how to communicate with skeptics. Even though fear sometimes can motivate some to action, Labaree said that they have had to pull back on fear because "people get too wrapped up in it and go down a rabbit hole, not getting the key messages."

Finally, there was discussion about how to make sure the participating students continue to work on their action projects. Wunar mentioned that because Chicago Public School requires service hours to graduate, many students will volunteer for this program and gain credit. Even after the students fulfilled their required weeks, they kept coming back. Wunar and his team had to strategize how to expand the opportunity for the students that chose to stay. Elizabeth River Project and The Wild Center provide teachers stipends. The Wild Center's events also offer pizza and music and "fun community building." Krester said, "it's an opportunity for students to do something that is real, where they can make a difference."

Breakout Session

Discussion on the emotional impact of climate change continued during the breakout sessions. The sessions included similar themes as the panel, such as how to talk about the gravity of the issue without overwhelming participants. For instance, the project with Maritime Aquarium at Norwalk starts out with a short, solid lecture about the science behind climate change but then dives into what students can do in a manageable scale.

Another theme that emerged is that it is important to know your audience. For example, some community members may be triggered by discussing certain climate impacts, so it may be more effective to talk about an issue that has not caused community trauma (e.g., heat rather than hurricanes). Other school groups may feel angry about these impacts, so help move them from blaming to empowerment/collective responsibility. Sometimes you need to address or incorporate injustice into the discussion because some communities are not thinking about climate change at the larger or abstract level.

Other ways to empower students and generate hope were discussed. For instance, Lisa Gardiner of the University Corporation for Atmospheric Research (UCAR) said that students collecting data "is their power." Watershed Management Group uses their rain gardens as a source of empowerment because students can see what they have transformed. It was mentioned again that letting youth identify issues that are personally important to them are great entry points, and then you can dive into a topic, challenging the students to come up with solutions, without feeling like it is disconnected from personal experiences.

As shown throughout the panel and the breakout discussion, student-led projects that focus on hope and students' passions can lead to empowerment and ultimately engaged citizens. Adults likewise need to see more than just data or numbers on a graph. Talking about and visualizing their community and sharing stories is an effective way to engage participants in resilience projects. Finally, sticking with the common theme throughout the workshop, focusing on social justice concepts can help connect some communities to climate change, as these can often be more tangible issues than seemingly "far away" weather impacts.

Curriculum Used in Resilience Education

Panel Overview

The next grantee panel held on day one was facilitated by Maggie Allen from NOAA's Office of Education, and focused on curriculum used in resilience education. Panelists included Bekah Stendahl, Education Programs Manager at the New England Aquarium; Emily Fano, Senior Education Manager for the Resilient Schools Consortium (RiSC); Chrissy Webb, Washington Service Corps Member at the Nisqually River Education Project; and Jennifer Sloan, Director of Education for the Groundwork Hudson Valley project.

Bekah Stendahl provided an overview of the "Community Partners for Resilience" project hosted by the New England Aquarium. This project is a three-year initiative to bring community leaders and planning experts together with educators and students to utilize schools and afterschool programs as venues for engaging broad audiences in the climate resilience planning process in the municipalities of Lynn, Chelsea, and Hull, Massachusetts. Their work has comprised developing 4th-8th grade curriculum units using a project-based learning curriculum model, developing public education projects, and holding a teacher institute in the summer of 2018. The team utilized numerous NOAA assets to develop the curriculum. In particular, the U.S. Climate Resilience Toolkit laid the foundation for the units and allowed the group to use a holistic, systems-thinking framework to identify steps for engaging students in the complex challenges climate change poses to their communities. Additionally, this curriculum was built using student voice and choice, and allowed them the opportunity to engage with local officials working to address these challenges on the ground.

Emily Fano reviewed the work that has been accomplished through the Resilient Schools Consortium (RiSC) in Brooklyn, New York. This project, led by Brooklyn College in partnership with the National Wildlife Federation, aims to educate students about local climate change impacts and resilience solutions, and prepares them to participate and engage with local climate resilience planners and practitioners. The RiSC program developed a curriculum in conjunction with the OneNYC climate resilience plan, which was disseminated into six middle and high schools. Three of these schools were significantly impacted by Superstorm Sandy in 2012. The RiSC project also focused on teacher professional development and teacher empowerment. The project utilized multiple NOAA assets, including the U.S. Climate Resilience Toolkit. Notable successes of the RiSC project are the connections being made between students, teachers, and local resilience professionals, and the fact that the OneNYC plan was updated to include a paragraph about resilience education to reflect the important work done by this team.

Chrissy Webb shared the work accomplished by the Nisqually River Education Project located in Washington State on the Nisqually watershed. There are a wide-range of partners working on this

project, including the Mount Rainier Institute, South Sound Green, and Capital Region ESD 113. The aim of the work is to provide students service-learning, science-based projects to link Washington's learning standards with local environmental issues, ultimately inspiring stewardship of the Nisqually watershed and beyond. The three major project components– the Summer Institute for Teachers/Climate Resiliency Fellows program, the Climate Resilient Youth Leadership Programs, and the Action Projects for Community Resilience–complement one another and aim to foster resilient climate leaders, communities, and coastal ecosystems. Working with 2nd-12th grade teachers and students in South Puget Sound communities, this project engages Nisqually, Squaxin Island, and Chehalis tribal communities and spans five counties. Each of the project components help contribute to deeper engagement with climate resilience and stewardship concepts, and created opportunities for students and educators to collaborate with local partners and tribal communities.

Jennifer Sloan shared the progress of the "Global, Local, Coastal" Groundwork Hudson Valley project in Yonkers, New York. Funded by an ELP grant in 2015, this project partnered with the Yonkers Board of Education to identify 12 classes among four high schools to implement programs. Additional partners include the Science Barge, the Center for the Urban River at Beczak at Sarah Lawrence College, and more. Experiential resilience education was a major focus of programming. The project was able to organize and arrange for 600-700 students to attend field trips to outdoor education centers. Additionally, they created a distance learning module that contained teacher resources, a comprehensive curriculum with classroom and outdoor activities, and three webinars directed at environmental educators and youth leaders. Overall, the Global, Local, Coastal project provided interactive, hands-on, and place-based opportunities to engage with climate literacy and community resilience.

Panel Discussion

A few themes arose in the discussion period that followed the panelists' presentations. Attendees were interested in learning about how much time the panelists spent on the mechanics of climate change verses how to take action to address the challenges it poses. Having a strong foundational understanding of climate science was important in each project, and the panelists emphasized the importance of helping students approach the issue from a systems perspective. Additionally, project-based activities make the science behind climate change more approachable.

The panelists were asked to speak about the sustainability of their projects beyond the duration of the ELP grant. Jennifer explained that the distance learning module they developed was a method of disseminating knowledge and distributing the curriculum they created. Bekkah noted they plan to continue working with their partners in the Metropolitan Planning Council, and that a civic engagement bill was recently passed in the Boston area with which they plan to connect. Lastly, Emily shared that their work will continue with the help of a grant from FEMA, and that

the New York City Department of Education is considering district-wide adoption of the RiSC curriculum.

Breakout Session

The resilience education versus climate change education curriculum breakout session focused on unpacking the differences between each approach, and the challenges and opportunities that each presents. There were discussions about the action and solutions-oriented message that accompany resilience education, while climate change education is largely focused on natural Earth systems and delivering related science concepts. Along these lines, some attendees felt that resilience education offered an empowerment lens that can counteract feelings of hopelessness or apathy that can arise from a purely climate science education approach. Attendees brought to light that resilience education incorporates more social and behavioral science principles into the climate science equation, and offers students opportunities to identify possible interventions that can have immediate and lasting impact.

There was discussion about resilience education in municipal settings. Educating adults about climate resilience in informal settings was raised as a challenge, as many adults have preconceived understandings of the term resilience, and sometimes are afraid to admit that they are lacking a strong foundation in climate literacy. Students, on the other hand, are quick to grasp the issue, are trusted messengers on the topic, and are able to communicate the importance of climate resilience from an intergenerational perspective.

Overall, helping to foster a systems-thinking approach to climate resilience in students and adults is key to addressing these issues. Furthermore, environmental educators should be careful and attentive to their use of terminology, and should consider how different audiences understand the concept of resilience. Resilience education offers students and adults a sense of hope, self-efficacy, and an action-oriented approach to addressing local climate challenges. Some attendees argued that there is a moral imperative first to build a foundational understanding of the Earth system science of climate change before moving to educating about ways to address the intricate challenges posed by a changing climate.

Perspectives on Working with Local Officials

Panel Overview

The last panel held on day one was facilitated by Bekah Stendal from the New England Aquarium, and centered discussions around perspectives on working with local officials. Panelists (all non-grantees) included Melissa Deas, Climate Program Analyst from the DC Department of Energy & Environment, and Kristin Baja, Climate Resilience Officer from the Urban Sustainability Directors Network.

Melissa Deas provided an overview of the Climate Ready DC plan, and the work done by the District to make the plan more human-centered. One such effort was the creation of an Equity Advisory Group, where they convened a group of 13 residents from a community east of DC's Anacostia River to address local social and climate challenges. This group included a neutral facilitator and an external evaluator who observed the entire community planning process and provided mid-term and end-of-term feedback. Community members of the Equity Advisory Group were paid $25/hour for their time and contributions, and meeting times were held after normal working hours and within walking distance of member's homes. Over the span of seven months, the Equity Advisory Group was able to develop recommendations for equitable, neighborhood-scale actions to increase community resilience in DC. The top three recommendations were to:

1) Create neighborhood scale resilience hubs;
2) Create an integrated workforce development program; and
3) Expand workforce opportunities for youth.

It becomes apparent from these recommendations that community resilience encompasses much more than a community's ability to withstand or adapt to environmental stressors and shocks. Affordable housing and workforce development are equally as important as disaster preparedness. The DC Department of Energy and the Environment and the Equity Advisory Group were able to address resilience challenges by driving action in priority neighborhoods, addressing stormwater through innovative policy, and assessing vulnerability in affordable housing.

Kristin Baja spoke about her work with the Urban Sustainability Directors Network, with a specific emphasis on the need to center equity and address institutional and structural racism in order to get to some of the root causes of acute vulnerability. She spoke about the different shocks (i.e. fires, hurricanes, earthquakes, and floods), and stressors (i.e., endemic violence, high unemployment, endemic drug use, and poverty) that contribute to a community's adaptive capacity. Baja's ideas built on the message that Deas had delivered explaining that lasting community change must be community-led, and that if you have community members participating in your work, they should be monetarily compensated for their time and for the

lived wisdom they are sharing. A community-led resilience planning practice would prioritize neighborhoods with the highest historic disinvestment, would actively listen to residents and collect their stories and needs, and would build trust and relationships. Additionally, community members should help identify partners for project implementation. Baja stressed that the government cannot act alone in regard to community and climate resilience, and agencies and organizations need to avoid working in silos—resilience, mitigation, adaptation, and equity need to be addressed simultaneously.

Panel Discussion

During the question and answer period following the panel, one attendee asked for suggestions to keep community members engaged in interdisciplinary working groups. Deas and Baja suggested utilizing a diversity of techniques to garner input from the community, and to try to move away from presentation-heavy meetings. Interactive activities such as the Game of Floods or the Game of Extremes are stimulating ways to get community members to begin thinking about the challenges facing their communities in systemic ways. Furthermore, offering community members a clear explanation of how their participation will be utilized, and what types of opportunities are available to them to continue contributing are good ways to keep people invested.

One theme that arose during the discussion was the importance of recognizing cultural and individual trauma that communities face when dealing with exposure to environmental threats and extreme weather events. Deas and Baja suggested incorporating methods to handle trauma as a component of local resilience planning processes, and that groups can identify local community partners who are more advanced in this field than the local government. This represents opportunities for communities to heal from the trauma caused by environmental hazards.

Participants then discussed the concept of trust. Attendees noted that community members are often skeptical and cynical about the government, and asked for advice on how to break down those barriers. The panelists explained that community-driven, equitable planning needs to communicate how the process will benefit the participants. Additionally, the onus should be on the organization or local government to do targeted outreach and put in the time to build trusted relationships with local community leaders. It is beneficial to invite participation from local institutions, community-based organizations, or faith-based institutions that are familiar to and trusted by community members. Through these efforts, resilience practitioners and educators can ensure that their efforts will be better understood and accepted by the communities in which they work.

Citizen Science to Advance Resilience

Panel Overview

Day two of the meeting began with a grantee panel focused on the use of citizen science to advance resilience. Facilitated by John McLaughlin of NOAA's Office of Education, panelists included Tom Naiman, Director of Education for the Maritime Aquarium at Norwalk; Joaquin Murrieta-Saldivar, Cultural Ecologist with the Watershed Management Group; Jeremy Hoffman, Climate and Earth Scientist with the Science Museum of Virginia; and David Sittenfeld, Manager of Forums and National Collaborations at the Museum of Science in Boston.

Maritime Aquarium at Norwalk's project, "Sound Resilience", is in its third year, and operates in 11 coastal towns in Connecticut and has hosted 75 classes to around 1,400 students to date. Naiman said that because a lot of wealthy individuals live on the Connecticut coast, there is a misconception that only the wealthy care about sea level rise. However, their program has helped increase understanding that coastal hazards, such as sea level rise, affect entire communities. Their program has three main components including coasts that shift and change, your coast through new eyes, and mission: protect your coast. Each of these involve working with diverse communities to become more resilient to relevant environmental hazards. Students stated they have learned more about these issues, and teachers have especially appreciated the hands-on and role-playing components.

The Watershed Management Group (WMG)'s project, "Recharge the Rain," helps students create more shade in their Tucson-area schoolyards through the installation of rainwater gardens. These gardens serve multiple purposes; they diminish the heat island effect, retain rainwater, beautify their campuses while serving as living laboratories for students. Through this program, students are becoming community ambassadors to create change in their schools and towns. Project WET, a major project partner, developed instructional modules for teachers and students to use to plan, install and maintain rainwater gardens. Ultimately, it is the students that are empowered, bringing their messages about adaptation to flooding and extreme heat events to their mayors and the school district leaders.

Jeremy Hoffman discussed how the Science Museum of Virginia is implementing resilience education in their programs and activities through their project, "Learn Prepare, Act – Resilient Citizens Make Resilient Communities." The museum uses compelling data visualization to highlight climate impacts, which allows people to explore these in an interesting interactive way. The museum team realized they needed to focus their activities on localized climate change impacts in order to connect with and empower their community, so they decided to focus on the urban heat island effect. With this issue, people can feel hope because they work on a micro-scale issue in their neighborhoods. Besides the urban heat island study, the museum has

also educated the public on climate science concepts in their Dome theatre and with Science On a Sphere®; hosted a lecture series; an event featuring creative ways to display climate datasets; and other role-playing weather games. Hoffman emphasized that museum educators need to feel confident in order for guests to feel the same. The same people week after week came to the lectures, which showed consistent interest in discussions rather than unique visitations.

David Sittenfeld of the Museum of Science in Boston discussed their "Community Partnership for Resilience" project, "Citizen Science, Civics and Resilient Communities" project, and their science center public forums. The project had eight daylong public deliberations at U.S. science centers, exploring the most common climate-related hazards (sea level rise, extreme precipitation, drought, and heat waves) in four generic cities. Utilizing city climate resilience plans and research literature, as well as expert and stakeholder input, the team created scenarios that help deliberators visualize place-based vulnerabilities and explore trade-offs with different solutions. Participants in the deliberations learned science, even though the focus was mostly on policy strategies. The Museum of Science received a new award, starting in 2018. They will build upon the previous project by deepening the involvement of the participants in understanding their local threats and vulnerabilities through citizen science projects and participation in community dialogues about the hazards. The project will be implemented at 28 science centers across the United States.

Panel Discussion

During this thematic panel, there was again a heavy emphasis on social justice and how it relates to citizen science. For example, the Science Museum of Virginia's urban heat island project changed the way people see Richmond. Historically, Richmond was designed using redlining, where neighborhoods were segregated by race. Citizen scientists discovered the low-income, minority neighborhoods were warmer than the non-redlined neighborhoods. As Hoffman explained, "Urban heat island effect is a direct line to equity issues and a systemic underinvestment in those communities, related to health and wealth disparity and climate inequity."

The project representatives also discussed their approaches to recruiting participants. Overall, the programs' messaging focused more on community than resilience. The Museum of Science asked people to re-imagine their community, and Watershed Management Group told participants they could help the river flow through Tucson again and bring the identity of the city back. The Science Museum of Virginia recruited participants by partnering with nonprofits that are already working with low-income communities, so they met them in a place where their missions complemented each other.

In terms of what comes after these citizen science projects, the panelists listed multiple ways they hope participants will continue to take action in their communities. Watershed Management Group has created a program where students develop a 3-D model so they can identify where there could be green infrastructure, and students will be using that in community outreach in the future. Maritime Aquarium at Norwalk has a plan to develop the Next Generation Science Standards modules, which schools plan to adapt, that involve citizen science and river restoration. Hoffman said that future works depends on what is important for the communities as an outcome. For example, planting trees was a motivator for Baltimore, and there are policies being developed in Richmond that will use their urban heat island study for housing work.

Breakout Session

The breakout session on citizen science mainly focused on successes, challenges, and advice on how to be more successful and inclusive in these projects. In terms of challenges, workshop participants mentioned it can be difficult to engage students in citizen science activities when only showing numbers and data. Therefore, it is important to focus on issues the community has an urgent need for, and to also collect qualitative data, such as oral histories. Students can peer-review their own data, as this allows them to work on improving the dataset as a whole and to think about how these data may be used. People will be less likely to participate if they do not see how the data will be used, so sharing noteworthy results can be empowering.

Similar to the panel discussion, social justice was a main theme. Data may have unintended consequences for communities, so it is important to not exploit participants for information, and make sure you do no harm. For example, some fishing communities may not want to give away their “special places” or sometimes it may be traumatic for people to discuss natural disasters. Including communities in the design and distribution of the projects can help avoid these mistakes. It is essential to consider how power dynamics play out in these projects, especially with underrepresented communities.

As shown in the EJ sessions, the participants saw a great need to consider social justice within citizen science projects. This highlights the importance of focusing on social equity across all activities. With this rapidly growing field, it is important to recognize how data collected benefit both the people the projects serve and the broader scientific community.

Evaluation and Long-term Outcomes

On the third day of the meeting, a group of evaluators presented on project evaluation and long-term outcomes. The panel was facilitated by Brett Branco from Brooklyn College. Panelists included Katie Todd, Senior Research and Evaluation Associate with Museum of Science, Boston; Alexandra Gillis, Project Assessment and Evaluation Assistant with Brooklyn College; Kaitlyn Chandler, Research Associate with RK&A and reporting on the Science Museum of Virginia project; and Randi Korn, Intentional Practice Leader with RK&A and reporting on The Wild Center project. A second panel followed focusing on evaluation approaches, which was facilitated by David Sittenfeld from the Boston Museum of Science. Panelists included Jessica Sickler, Principal with J. Sickler Consulting and reporting on the Nurture Nature project, and Lisa Marckini-Polk, President of Civic Research Services, Inc. and reporting on the Michigan Sea Grant project.

Panel Overview

Katie Todd's presentation described the evaluation approach taken with two projects hosted by the Museum of Science in Boston. The first project, Science Center Public Forums, created forums which engaged participants in dialog around the topics of sea level rise, heat waves, extreme participation, and drought. Each forum consisted of background information, data visualizations utilizing NOAA assets, and discussion modules. The second project builds on the Science Center Public Forums and expands the forums from 8 sites to 28 sites. This project will pair each forum program with a citizen science project related to the specific hazard being addressed. The evaluation process for the Science Center Public Forum project has involved both formative and summative evaluation components. The formative evaluation process involved looking at individual pieces of project materials, while the summative evaluation analyzed the final products of the projects. Summative evaluation data was collected through three methods: an event sign-up sheet to collect contact and demographic information, an online pre-survey to garner qualitative and quantitative data about prior knowledge and experience, and a paper post-survey to gather data regarding current knowledge. The next phase of the project will undergo the same evaluation process.

Alexandra Gillis' presentation focused on evaluating the Resilient Schools Consortium (RiSC) project in Brooklyn, New York. Gillis' evaluation approach included one-on-one interviews with students, surveys of teachers and students, examinations of student projects, and classroom observations. From her methods, she was able to derive that when students say "climate change", they are really communicating "resilience", and this could have been a result of the activities and lessons the students were learning through the curriculum. Additionally, Gillis found that the students felt as if their voices were an important contribution to the climate change discussion. Students also value the opportunity to talk to the public about their resilience projects and were particularly excited about their role in addressing the challenges facing their neighborhoods.

Kaitlyn Chandler's presentation summarized the evaluation efforts she has conducted for the Science Museum of Virginia's "Learn, Prepare, Act" project. The overall evaluation was divided into three phases: a front-end evaluation consisting of 40 in-person interviews, a formative evaluation consisting of 42 interviews and five program observations, and a summative evaluation consisting of 52 interviews and five program observations. The programs included in the evaluation were the museum's Digital Dome, Extreme Event Challenge, Science On a Sphere®, Ready Rowhomes, and the Climate Connections lecture series. Chandler's analysis revealed that immersive displays and striking visuals help museum visitors process complex datasets. She found that integrating local examples into programs helps visitors develop a place-based understanding of climate change. Lastly, the evaluation results indicated that hands-on activities with decision-making components may help participants retain concepts of resilience, and can help counter feelings of hopelessness around climate change.

Randi Korn presented on her work with The Wild Center in Tupper Lake, New York. Korn's evaluation approach is guided by two evaluation frameworks: the Cycle of Intentional Practice (where evaluation, reflection, alignment, and planning all circulate around impact), and the Impact Pyramid (where indicators lead to outcomes which lead to impact). Korn described the process they underwent for clarifying impacts, which consisted of a facilitated workshop with all partners, teachers, and stakeholders. Participants worked on three exercises in small teams: a passion exercise, a distinct qualities exercise, and an envisioning outcomes exercise. Based on the results of the group work, Korn was able to populate an impact framework, which is serving as a planning and evaluation tool for the project.

Jessica Sickler shared her work regarding the evaluation of the "CREATE Resilience" project. Sickler has created an evaluation framework that groups experiences to be hosted by Nurture Nature through the CREATE Resilience project into the following categories: youth ambassador activities, public education events, public forums, and public murals. Looking at the outcome that the CREATE Resilience project hopes to achieve—communities implementing a shared vision of resilience—Sickler sought out methods to measure this community-level change. She turned to the field of community development for examples of measuring progress. Sickler plans to employ multiple evaluation methods such as surveys and social media analysis. Additionally, she plans to utilize "ripple effect mapping", a method that documents results of complex, community-level interventions. This method comes from the field of appreciative inquiry, and will allow for stakeholders to describe observed impacts, identify thematic groupings, and articulate linking pathways within their community.

Lisa Marckini-Polk discussed the planned evaluation of the Michigan Sea Grant "Resilience from the Youth Up" project. Marckini-Polk sought guidance from systems-change evaluation literature for how to approach the evaluation of this project. The project evaluation will include

measuring how effectively all of the partners involved in the project are working together to achieve the goals of the project, and examining the various benefits realized by the project partners. The Wilder Collaboration Factors Inventory is a tool that can help measure a group's collaborative strengths and needs, and will be used in this evaluation. Additionally, evaluation will focus on assessing student gains in understanding of climate adaptation, mitigation, and resilience in their communities, and in increased civic engagement in relation to climate resilience. These questions will be addressed by utilizing pre- and post-intervention testing and surveys. Marckini-Polk and the Michigan Sea Grant project team decided against trying to quantify the outcomes of student-led work, and rather are asking each classroom team to develop a product describing their project and outreach efforts. Marckini-Polk will also provide guidebooks for interested students to personally assess the impact of their outreach on audiences, and the impact of their projects on the environment.

Panel Discussions

Important questions and observations were raised in the discussion that followed these presentations. There was a shared interest in exploring unintended outcomes, and investigating ways to capture how learning outcomes can transfer outside of museums or other informal learning institutions. Attendees were also curious about measuring changes in the community leaders or external partners who work on these projects to see if their involvement altered their own knowledge, skills, or behavior. Within each of these projects, the evaluators were tasked with capturing exactly how project activities contribute to the goals of the grant program. Through a wide variety of evaluation methods, these projects will help indicate how the activities are building a more environmentally literate populace. Each evaluator faced their own sets of challenges, but as Sickler said in the conclusion of her presentation, the question of how to measure a certain outcome should never stop you from striving for an important goal.

Resilience Education Theory of Change

The last presentation of the meeting focused on the work being done by Sea Grant Knauss Marine Policy Fellow Genie Bey and members of the Office of Education's ELP team to develop a Resilience Education Theory of Change (ToC). A draft version of the ToC was distributed at the workshop and can be found in Appendix D. Following the shift in focus from climate change education to community resilience education, ELP felt the need to create a document that communicates the overarching philosophy of the current focus of the grant program. This document will inform the creation of future funding opportunities and will serve as a reference for prospective applicants. Bey offered a summary of the ongoing process of ToC development, as well as information about the utility that ToCs can provide for evaluation and measuring progress for a program, project, or organization.

Before ELP's transition from funding climate change education to community resilience education, ELP participated in an interagency effort between NOAA, NASA, and NSF called the Tri-Agency Collaboration for Climate Education. This collaboration aimed to streamline climate change education efforts across the three agencies to reduce potential redundancies and create new opportunities for complementary work. One product that came from this effort was the creation of the Common Logic Model, which outlined the various inputs, audiences, activities, outputs, outcomes, and impacts the collaboration encompassed.

Analysis of the Tri-Agency Common Logic Model, in addition to nine logic models submitted by the 2018 grantees, provided a starting point for developing a ToC for resilience education. The team identified commonalities that could be synthesized to create a program-level ToC. Additionally, Bey began conducting a literature review to further inform the philosophical content of the ToC. ELP aims to make the development of this ToC an inclusive, iterative process, as the strongest ToC will be one that reflects the needs and desires of the community it represents.

Bey's presentation laid out the commonalities and distinctions between logic models and ToCs. Both are tools for planning, implementation, and evaluation that utilize an "if-then" approach. The major difference between the two tools is in their scope. ToCs are generally broader in scope and therefore more appropriate for a grant program encompassing multiple projects, while logic models are more narrow and therefore more useful at the project level to communicate the nuts and bolts of project implementation. ToCs communicate the essential components of a program, their relationship to each other, and how they fit together to achieve a long-term goal–it is the how and why an initiative accomplishes its mission (Bours, McGinn, and Pringle, 2014). Components of a ToC include a problem statement, intermediate outcomes, indicators and thresholds, and an end goal, with assumptions integrated in each step of the causal pathway. They are usually in the form of an infographic or diagram with an accompanying narrative.

Bey then explained the components of the ToC that had been drafted at the time of the workshop, including the reasoning behind this project, and the assumptions, problem statement, and end goal that fit into the theory (Appendix D). In summary, the ToC explains that in addition to the critical efforts of training practitioners and city officials on the most cutting edge tools and techniques being employed in climate and community resilience planning, there is also a need to equip community members with the environmental literacy necessary to make informed decisions about the place-based challenges facing their communities. ELP resilience grants offer a unique way to reach diverse audiences in both formal and informal educational settings to engage community members in hazard mitigation, adaptation, and resilience planning efforts. The Resilience Education ToC seeks to outline the ways in which resilience education can lead to increased community engagement and civic action, ultimately leading to a more healthy and social-ecologically resilient society.

In the discussions that followed the presentation, attendees highlighted components of the ToC that resonated with them. Specifically, the concepts of relationship building, social capital, and civic engagement were all highlighted as critical pieces. One attendee mentioned the importance of unexpected relationships or partnerships that can arise through the resilience education grant projects, and suggested that ELP consider how to incorporate this concept. This suggestion was echoed by others, who mentioned the need to include spontaneous collaborators, unintended consequences, and co-benefits that can arise in and between projects. There was a discussion about how the ToC will have both internal (e.g. NOAA) and external audiences (e.g. current and future grantees, grantee partners, potential applicants, other government agencies). One participant raised a concern with the use of the term “education”, stating that it could be off-putting or exclusionary to some audiences, and suggested using the term “awareness” instead. There was a discussion of how resilience may be best defined by the local community. Some participants agreed that allowing each grant project to define resilience for themselves might be a good solution. Participants suggested that the benefits of the ELP community of practice should be incorporated into the ToC. Furthermore, participants were pleased with the idea that the ToC process will be iterative, and are interested in providing more detailed feedback as it is being developed. Note: publication of the ToC is anticipated to occur in Fall 2019.

Takeaways and Next Steps

At the end of the three-day workshop, participants discussed major takeaways and next steps. The need to refine the concept of what it means to be resilient was identified as a key issue. Ideally, resilience would encompass more than recovering or bouncing back to a previous state that may not necessarily be good state, but also about transforming into a new, more sustainable and just society. Resilience, when done well, should consider all the stressors, including sociological ones, that exacerbate impacts of these shocks. The process of becoming resilient may involve community members re-imagining a new community, considering what they want their community to be like, and identifying what has to change in order to make that happen. Resilience planning is best done when all members of a community feel their opinions have been heard.

The intersection of environmental justice and resilience was also a recurring thread throughout the workshop. Grantees highlighted the need to understand the role of structural racism, such as redlining, in creating unjust environmental and social conditions. To ensure that the needs of the most vulnerable members of a community are considered, participants agreed it is necessary to consider engaging organizations that work in these communities. Best practices for this engagement include compensating community representatives for their expertise, recognizing cultural sensitivities, and creating safe spaces for engagement.

As noted in the thematic sessions, empowerment and hope are key to engaging members of a community. Citizen science is one way to do this, but it is important to understand barriers to participation and ultimately address these through intentional engagement. Localization of climate change issues also allows people to visualize solutions and can motivate them to take action. Students feel most empowered if they drive their own projects, focus on making their schools more resilient, or dive into an issue they are passionate about. Seeing the successes of their projects can inspire youth to become effective agents of change, impacting their neighborhoods, their states, and beyond.

At the same time, there are also powerful negative reactions to climate change, such as apathy and fear. Sometimes it may be traumatic to discuss certain climate events, especially if community members have survived a major disaster. Mental health issues are emerging as an issue embedded in resilience, and it is essential to remember this when creating projects and working with communities.

Other valuable approaches to educate participants on resilience include: using downscaled, physical models (e.g., Ready Row homes), role-playing games that explore the trade-offs in adaptation planning, map-making to visualize a town's preparedness and threats, and touring a

community with a resilience expert to see what is working and where there could be room for improvement.

Overall, this community of practice will continue to focus and build upon the themes highlighted in the workshop, both through the current projects and in future funding opportunities. In a post-workshop survey, many respondents stated that the ability to collaborate with grantees and to meet NOAA staff were the most valuable aspects of the workshop. Ninety-seven percent of the respondents stated that they found the workshop to be helpful for improving the effectiveness of their resilience education work. The grantees walked away from the workshop with more resources, more contacts, and more ideas about how to address their challenges and measure their impacts.

ELP will continue to build this grantee network, strengthen partnerships, and work to advance the field of resilience education. Projects funded under the next funding opportunity will be encouraged to consider and integrate these recommendations.

Appendices

Appendix A: Participants

Institution	Project	Name
Gulf of Maine Research Institute	Community Resilience Informed by Science and Experience (C-RISE)	Jonathan Labaree
Gulf of Maine Research Institute	Community Resilience Informed by Science and Experience (C-RISE)	Leigh Peake
Museum of Science, Boston	Citizen Science, Civics, and Resilient Cities	David Sittenfeld
Museum of Science, Boston	Citizen Science, Civics, and Resilient Communities (current) and Science Center Public Forums (past)	Katie Todd
Ecoworks Detroit	Climate Resilience from the Youth Up	Jordan Larson
Fond du Lac Tribal and Community College	Climate Strong	Courtney Kowalczak
New England Aquarium	Community Partnerships for Resilience	Bekah Stendahl
RK&A	Convening Young Leaders for Climate Resilience	Randi Korn
The Wild Center	Convening Young Leaders for Climate Resilience	Jen Kretser
The Wild Center	Convening Young Leaders for Climate Resilience	Erin Griffin
J. Sickler Consulting	CREATE Resilience	Jessica Sickler
Nurture Nature Center	CREATE Resilience	Kathryn Semmens
Nurture Nature Center	CREATE Resilience	Rachel Hogan Carr
Ocean Discovery Institute	Empowering Climate Change Resiliency through Education in an Underserved Community	Rochelle Mothokakobo

Ocean Discovery Institute	Empowering Climate Change Resiliency through Education in an Underserved Community	Jo Vance
Chugach School District	Environmental Literacy for Alaska Climate Stewards	Sheryl Sotelo
Chugach School District	Environmental Literacy for Alaska Climate Stewards	Doug Penn
Nisqually River Foundation	From Mount Rainier to the Pacific Coast	Emily McCartan
Nisqually River Foundation	From Mount Rainier to the Pacific Coast	Chrissy Webb
Groundwork Hudson Valley	Global, Local, Coastal: Preparing The Next Generation for A Changing Planet	Jennifer Sloan
University of Colorado Boulder	HEARTforce, CIRES	Erin Leckey
University of Colorado Boulder	HEARTforce, CIRES	Anne Gold
UCAR Center for Science Education	R4 Ed: Rigor, Relevance, and Relationships in Coastal Louisiana Resilience Education	Lisa S. Gardiner
University of Arizona	Recharge the Rain: Community Resilience through STEM Education	Kerry Schwartz
Watershed Management Group	Recharge the Rain: Community Resilience through STEM Education	Joaquin Murrieta-Saldivar
Civic Research Services, Inc.	Resilience from the Youth Up	Lisa Marckini-Polk
Brooklyn College	Resilient Schools Consortium (RiSC)	Brett Branco
Brooklyn College	Resilient Schools Consortium (RiSC)	Alexandra Gillis
National Wildlife Federation	Resilient Schools Consortium (RiSC)	Emily Fano
National Wildlife Federation	Resilient Schools Consortium (RiSC)	Heather Sioux
The Maritime Aquarium at Norwalk	Sound Resilience - Get on Board!	Tom Naiman
The Maritime Aquarium at Norwalk	Sound Resilience - Get on Board!	Avalon Bunge

Museum of Science and Industry	Teen Advocates for Community and Environmental Sustainability (Teen ACES)	Bryan Wunar
University of the Virgin Islands	USVI Storm Strong	Kristin Wilson Grimes
RK&A, Inc.	Your Actions Matter: Resilient Citizens Make Resilient Communities	Katie Chandler
The Science Museum of Virginia	Your Actions Matter: Resilient Citizens Make Resilient Communities	Jeremy S Hoffman
DC Department of Energy & Environment		Melissa Deas
Elizabeth River Project		Robin Dunbar
Empower DC		Parisa Norouzi
MD/DC Chapter of TNC and University of Maryland		Ariana Sutton-Grier
NAAEE		Drew Price
NAAEE		Tia Watkins
NAAEE		Regina Fong
NAAEE		Judy Braus
NAAEE		Sarah Bodor
NOAA Chesapeake Bay Office		Bart Merrick
NOAA Chesapeake Bay Office		Elise Trelegan
NOAA Climate Program Office		Frank Niepold
NOAA Climate Program Office		David Herring
NOAA Climate Program Office		Amara Huddleston
NOAA Climate Program Office		Sean Bath
NOAA Climate Program Office		Daniel Barrie

NOAA Climate Program Office		Tom Di Liberto
NOAA Office of Coastal Management		Jim Foley
NOAA Office of Education		Andrea Sassard
NOAA Office of Education		Sarah Schoedinger
NOAA Office of Education		Jaime Frungillo
NOAA Office of Education		Maggie Allen
NOAA Office of Education		Genie Bey
NOAA Office of Education		John Baek
NOAA Office of Education		Carrie McDougall
NOAA Office of Education		Christopher Nelson
NOAA Office of Education		John McLaughlin
NOAA Office of Education		Lauren Gibson
NOAA Office of Education		Bronwen Rice
NOAA Office of Education		Christos Michalopoulos
NOAA Office of Legislative Affairs		Melanie Jackson
NOAA/CPO/RISA		Caitlin Simpson
NOAA/National Centers for Coastal Ocean Science		David Kidwell
Office of Senator Ed Markey		Julia Mason
RISA Program, NOAA		Chelsea Combest-Friedman
Sierra Club		Leslie Fields
U.S. Global Change Research Program, Office of Science and Technology Policy		David Reidmiller
Urban Sustainability Directors Network		Kristin Baja
WE ACT for Environmental Justice		Kerene Tayloe

Appendix B: Agenda

Day 1 - Monday, April 29th

TIME	SESSION
8:30-9:00am	**Check In** (snacks, coffee/tea provided)
9:00-9:45am	**Introduction and Welcoming Remarks** *Carrie McDougall, Senior Program Manager, NOAA Office of Education* *Sarah Schoedinger, Senior Program Manager, NOAA Office of Education* *Louisa Koch, Director of Education, NOAA* *Judy Braus, Executive Director, North American Association for Environmental Education, NAAEE* **Icebreaker** Within each table, introduce yourself to your neighbor and tell them something that's a unique fact about your institution
9:45-10:30am	**Panel: Intersection of Environmental Justice and Resilient Communities** Panelists: *Parisa Norouzi, Executive Director, Empower DC* *Kerene Nicole Tayloe, Director of Federal Legislative Affairs, WE ACT for Environmental Justice* *Leslie G. Fields, Director, Environmental Justice and Community Partnerships, Sierra Club* Facilitator: Jen Krester, The Wild Center
10:30-10:45am	**Break** (snacks, coffee/tea provided)
10:45-11:45am	**Grantee Panel: Emotional Impact from Climate Change** Panelists: *Jen Kretser, Director of Programs, The Wild Center* *Robin Dunbar, Deputy Director - Education, Elizabeth River Project* *Bryan Wunar, Director of Community Initiatives, Museum of Science and Industry* *Jonathan Labaree, Chief Community Officer, Gulf of Maine Research Institute*
11:45-1:15pm	**Lunch** (on your own)
1:15-1:45pm	**Science On a Sphere Presentation (Optional)** *(Building 3, 1315 East-West Highway)* Presenter: *Tom DiLiberto, meteorologist, NOAA's Climate Program Office*
1:45-2:00pm	Transition back to NOAA Science Center
2:00-3:00pm	**Grantee Panel: Curriculum Used in Resilience Education** Panelists: *Bekah Stendahl, Education Programs Manager, New England Aquarium* *Emily Fano, Senior Education Manager, RiSC - National Wildlife Federation*

	Chrissy Webb, Washington Service Corps Member, Nisqually River Education Project *Jennifer Sloan, Director of Education, Groundwork Hudson Valley*
3:00-3:30pm	**NOAA Education Promoting Your Work** NOAA's Environmental Literacy Program Grants Team discusses how the office uses grantee data for congressional briefings and to tell effective stories. *Christopher Nelson, Grants Analyst, NOAA Office of Education*
3:30-3:45pm	**Break** (snacks, coffee/tea provided)
3:45-4:55pm	**Panel: Perspectives on Working with Local Officials** Panelists: *Melissa Deas, Climate Program Analyst, DC Department of Energy & Environment* *Kristin Baja, Climate Resilience Officer, Urban Sustainability Directors Network* Facilitator: Bekah Stendahl, New England Aquarium
4:55-5:00pm	**Wrap-up of Day 1**
5:00pm	**Adjourn**
5:00-7:00pm	**Happy Hour (Optional)** Location: Denizen's (1115 East West Highway, Silver Spring, MD 20910)

Day 2 - Tuesday, April 30th

TIME	SESSION
8:30-9:00am	**Check In** (coffee/tea/snacks provided)
9:00-9:05am	**Overview of Day 2 and Announcements**
9:05-10:05am	**Grantee Panel: Citizen Science to Advance Resilience** Panelists: *Tom Naiman, Director of Education, and Avalon Bunge, STEM Education Specialist, Maritime Aquarium at Norwalk* *Kerry Schwartz, Extension Specialist & Director of Arizona Project Wet and Joaquin Murrieta-Saldivar, Cultural Ecologist, Watershed Management Group* *Jeremy Hoffman, Climate and Earth Scientist, Science Museum of Virginia* *David Sittenfeld, Manager, Forums and National Collaborations, Museum of Science*
10:05-10:30am	**Break**
10:30-11:15am	**Keynote on Nature-based Solutions to Climate Change Impacts** *Arianna Sutton-Grier, Associate Research Professor at the University of Maryland in the Earth System Science Interdisciplinary Center (ESSIC) and Director of Science for the MD/DC chapter of the Nature Conservancy*
11:15-11:50am	**2018 Environmental Literacy Grantees Panel**

	Panelists: *Anne Gold, Director, Education and Outreach, University of Colorado -Boulder* *Lisa S. Gardiner, Educator, UCAR* *Jordan Larson, Green Schools Coordinator, Ecoworks Detroit (Associated with Michigan Sea Grant project)* *Rachel Hogan Carr, Executive Director, Nurture Nature*
11:50-1:20pm	**Lunch** (on your own)
1:20-2:50pm	**Expo/Share-a-thon** Interactive, Expo-style and Grantee Share-a-thon that allows attendees to visit different demo stations featuring NOAA resilience assets such as Citizen Science, B-WET, Climate.gov, and other NOAA programs that either support resilience. Additionally, some ELP grantees will share a product or approach they have developed through their ELP-funded project.
2:50-3:05pm	**Break** (snacks, coffee/tea provided)
3:05-3:40pm	**2018 Environmental Literacy Grantees Panel** Panelists: *Rochelle Mothokakobo, Student Initiative Manager, Ocean Discovery Institute* *Doug Penn, Administrator, Chugach School District* *Courtney Kowalczak, Director, Fond du Lac Tribal and Community College* *Kristin Wilson Grimes, Research Assistant Professor, University of the Virgin Islands*
3:40-4:40pm	**Panel: Climate Science Update** Panelists: *David Reidmiller, PhD, Director, National Climate Assessment, U.S. Global Change Research Program, Office of Science and Technology Policy* *Daniel Barrie, PhD, Program Manager, NOAA Climate Program Office* *David Kidwell, Director, Competitive Research Program, NOAA/National Centers for Coastal Ocean Science* Facilitator: Leigh Peake, Gulf of Maine Research Institute
4:55-5:00pm	**Wrap-up of Day 2**
5:00pm	**Adjourn**
5:00-7:00pm	**Happy Hour** Silver Branch Brewery 8401 Colesville Rd #150, Silver Spring, MD 20910

Day 3 – Wednesday, May 1st

TIME	SESSION
8:30-9:00am	**Check In** (coffee/tea/snacks provided)
9:00-9:05 am	**Overview of Day 3 and Announcements**
9:05-9:50am	**Panel: Evaluation and Long-Term Outcomes** Panelists: *Katie Todd, Senior Research and Evaluation Associate, Museum of Science, Boston* *Alexandra Gillis, Project Assessment and Evaluation Assistant, Brooklyn College* *Kaitlyn Chandler, Research Associate, RK&A (Associated with the Science Museum of Virginia)* *Randi Korn, Intentional Practice Leader, RK&A (Associated with The Wild Center)* Facilitator: Brett Branco, Brooklyn College
9:50-9:55 am	**Transition to second evaluation panel**
9:55-10:35 am	**Panel: Evaluation Approaches and Program-Level Theory of Change** Panelists: *Jessica Sickler, Principal, J. Sickler Consulting (Associated with Nurture Nature project)* *Lisa Marckini-Polk, President, Civic Research Services, Inc. (Associated with Michigan Sea Grant project)* *Genie Bey, Knauss Marine Policy Fellow, NOAA Office of Education* Facilitator: David Sittenfeld, Museum of Science, Boston
10:35-10:45am	**Break** (snacks, coffee/tea provided)
10:45-12:15pm	**Concurrent Roundtable Discussions** Two, 40-minute "breakout" sessions, with a 10-min break in between. Attendees will choose among the following topics: 1. Program-level theory of change 2. Social and environmental justice in resilience 3. Resilience education vs. climate education, including curriculum 4. How to address emotional impact on students and public of climate change 5. Citizen science to advance resilience
12:15-12:45pm	**Major Findings/Takeaways of Workshop**
12:45-1:00pm	**Wrap-up/Concluding Remarks** *Christos Michalopoulos, Deputy Director, NOAA Office of Education* *Carrie McDougall, Senior Program Manager, NOAA Office of Education* *Sarah Schoedinger, Senior Program Manager, NOAA Office of Education*
1:00pm	**Adjourn**

Appendix C: Projects, Institutions, and Abstracts

(Listed in order of year funded)

1) Global, Local, Coastal: Preparing The Next Generation for A Changing Planet
Groundwork Hudson Valley · Yonkers, New York
Year: 2015

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.

2) Science Center Public Forums: Community Engagement for Environmental Literacy, Improved Resilience, and Decision-Making
Arizona State University (ASU) / Consortium for Science, Policy & Outcomes · Tempe, Arizona
Year: 2015

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.

3) Public Libraries Advancing Community Engagement (PLACE)
Califa · San Mateo, California
Year: 2015

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.

4) Learn, Prepare, Act: Resilient Citizens Make Resilient Communities
Science Museum of Virginia Foundation / Science Museum of Virginia · Richmond, Virginia
Year: 2015

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 to advance environmental literacy and share its vast knowledge with others.

5) Community Resilience Informed by Science and Experience (C-RISE)
Gulf of Maine Research Institute · Portland, Maine
Year: 2015

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.

6) From Mt. Rainier to the Pacific Coast: Fostering Resilient Climate Leaders, Communities and Coastal Ecosystems
Nisqually River Foundation · Olympia, Washington
Year: 2015

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 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.

7) Teen Advocates for Community and Environmental Sustainability (Teen ACES)
Museum of Science and Industry · Chicago, Illinois
Year: 2016

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 system 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.

8) Preparing Norfolk Area Students for America's Second Highest Sea Level Rise
Elizabeth River Project · Portsmouth, Virginia
Year: 2016

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, Virginia. The 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 will be disseminated nationally and 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 thus far with adults in mind.

9) Recharge the Rain: Community Resilience through STEM Education
Watershed Management Group · Tucson, Arizona
Year: 2016

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.

10) Resilient Schools Consortium (RiSC) Program
Research Foundation of CUNY / Brooklyn College · Brooklyn, New York
Year: 2016

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.

11) Sound Resilience-Get on Board!
Maritime Aquarium at Norwalk · Norwalk, Connecticut
Year: 2016

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 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 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.

12) Community Partnership for Resilience
New England Aquarium Corporation / New England Aquarium (NEAq) · Boston, Massachusetts
Year: 2017

The New England Aquarium will work with the Metropolitan Area Planning Council to establish Community Partnerships for Resilience (CPR), which will create community partnerships in three Boston-area communities that face severe risk from a changing climate Chelsea, Hull, and Lynn, Massachusetts. CPR will facilitate Community Teams of local professionals with diverse and relevant expertise in climate science, engineering, community planning and community action, and representatives from local schools or school-based educational programs serving youth in grades 4 through 8. Each team will identify the most critical, climate-related issues for their area that would benefit from public involvement and understanding. Then they will inform the design of learning activities and youth-focused climate resilience toolkits; serve as resources for teachers and students; and facilitate student-led projects to engage parents, peers, and other community members. Students themselves represent a key constituency they will be most directly impacted by future changes and they will need civic capacity to foster positive change. Project evaluation will assess student learning and indicators of community engagement to provide both formative feedback and summative assessment of the project impacts.

13) Convening Young Leaders for Climate Resilience in New York State
Natural History Museum of the Adirondacks / The Wild Center · Tupper Lake, New York
Year: 2017

The Wild Center s Convening Young Leaders for Climate Resilience in New York State project will increase climate literacy among high school students and teachers in New York City, the Catskills and the Adirondacks and give students the leadership skills to help their communities respond to the impacts of climate change. Working with Cornell Cooperative Extension of Delaware County, the Kurt Hahn Expeditionary Learning School in Brooklyn, and the Alliance for Climate Education, along with NOAA, the New York State Office of Climate Change and NYSERDA, the project comes at a time when the impacts of climate change loom larger than ever. But today's youth the generation most likely to mitigate its impacts have had little

exposure to the issue: Just 25 percent of American teens demonstrate a basic understanding of it. Project partners will incorporate state, regional and local planning in their efforts, which will establish Youth Climate Summits and Youth Climate Leadership Practicums in the three project regions; build on educators interests through a Teacher Climate Institute; and communicate climate change science and resilience through community outreach activities. By the conclusion of the project, we expect to work directly with more than 600 students and 200 teachers, each of whom will gain a better understanding of the impacts of climate change in New York State, a greater capacity to make informed decisions about the threats to their own regions, and a stronger connection with other community members and ongoing resiliency work. In addition, the project will also create replicable tools, video documentation for local outreach, and training approaches for youth leadership and teachers regardless of their location.

14) R4Ed: Rigor, Relevance, and Relationships in Resilience Education
University Corporation for Atmospheric Research (UCAR) Center for Science Education · Boulder, Colorado
Year: 2018

In this project, high school students in Houma, Louisiana, will investigate which areas of their community are most vulnerable and what can be done to be resilient in the face of hurricanes and sea level rise, today and in the future. To do this, they will collect local stories of coastal erosion, hurricane damage, and disappearing land and compare them with data from the NOAA Digital Coast Tool and the NCAR Cyclone Damage Potential (CDP) Index. Linking the impacts that community members have experienced with the data about these events and future projections, students will identify vulnerable areas in their community, identify the types of hurricanes that have been the most destructive to their community, and make resilience recommendations that they will present to their peers and the community at large. Project partners, the UCAR Center for Science Education, the NCAR Capacity Center for Climate and Weather Extremes, and the South Louisiana Wetlands Discovery Center, will develop the curriculum, facilitate the instruction, and disseminate the educational resources to other coastal educators. The successful completion of this project will result in a model approach for how students in other coastal communities can use data, stories, and the CDP as they engage in coastal resilience planning. This model approach will be described in a collection of educational resources, allowing educators to implement the approach with students in other Gulf Coast and Atlantic locations affected by hurricanes and sea level rise.

15) Citizen Science, Civics, and Resilient Communities (CSCRC)
Museum of Science Boston · Boston, Massachusetts
Year: 2018

The "Citizen Science, Civics, and Resilient Communities" education project led by the Museum of Science, Boston in partnership with Arizona State University and Northeastern University will increase resilience to extreme weather and environmental hazards through citizen-created data, local knowledge, and community values. Building upon previous funding from NOAA in which a set of modules were created and used to engage participants in active learning and resilience planning about four natural hazards (heat waves, sea level rise, extreme precipitation, and drought), the museum and its partners will add participatory citizen science activities selected in close collaboration with resilience planners. This new and expanded project will involve diverse groups of participants at 28 U.S. science centers collecting, analyzing, and sharing data relevant to local resilience planners, learning about vulnerabilities through visualizations of geospatial data and deliberative problem-solving, sharing perspectives about resilience strategies and their societal and environmental trade-offs, formulating community resilience plans, and presenting findings and recommendations to resilience planners and publics. The project aims to formulate a theory of action that sustains engagement and increases environmental literacy among participants, contributes citizen-created data, knowledge and values to resilience planning, and increases capacity among science centers for including publics in resilience planning and data collection.

16) Resilience from the Youth Up
University of Michigan / Michigan Sea Grant · Ann Arbor, Michigan
Year: 2018

As climate impacts ratchet up across the United States, the Great Lakes region tends to fly under the national radar. While the Great Lakes do not experience hurricanes, rising sea levels, or large-scale wildfires, the local climate has become increasingly erratic in recent years. The region, however, is one of the most unprepared in the country to cope with these impacts. A recent Grosvenor report (2014) on climate resilience among 50 global cities ranked Detroit last among 11 U.S. cities for adaptability and only better than three cities for overall resilience, which incorporates both climate vulnerability and adaptability factors. Of U.S. cities with more than 100,000 residents, Detroit has the highest percentage of African-American residents (80.7%, U.S. Census 2016). Still recovering from bankruptcy, the city also has a 39% poverty rate, which impacts over 56% of children (ibid). These socio-economic factors, coupled with other environmental justice concerns, such as a centrally located incinerator and an asthma rate of 15.5% among adults resulting in over 3,000 hospitalizations annually, make Detroit residents particularly vulnerable to climate impacts. This project will address the urgent need to increase resilience by working with high school students and teachers in Detroit and southeast Michigan to increase their awareness of climate change and develop projects that help their schools and neighborhoods become resilient to increased occurrence and intensity of heat waves, storm events, and flooding. Using NOAA assets, including GLISA localized climate data and Sea Grant outreach and education expertise, high school students and teachers will partner with

climate scientists to explore local climate impacts firsthand and to develop resilience strategies and projects that protect vulnerable households and neighborhoods and contribute to broader sustainability initiatives. The City of Detroit seeks this involvement as it ramps up a new Office of Sustainability and seeks proposals to develop the city's first Sustainability Framework. The effort is a partnership with EcoWorks, Great Lakes Integrated Sciences + Assessments (GLISA), Michigan Sea Grant (MISG), Southeast Michigan Stewardship Coalition (SEMIS), Eastern Michigan University, Civic Research Services, Inc., and the National Oceanic and Atmospheric Administration (NOAA). In each of the next three years, 200 students from various high schools in the Detroit and Ypsilanti areas will participate in weekly activities related to the grant. The four primary objectives of the program include: 1) Engage students in assessing and quantifying climate vulnerabilities of their schools, neighborhoods, and surrounding community. 2) Using a place-based education (PBE) model, prepare educators to engage students in creating plans and completing projects that increase community resilience. 3) Empower high school students to teach residents about local climate impacts and increase understanding of resilience strategies to mitigate extreme weather events or other environmental hazards. 4) Contribute to the completion and implementation of local sustainability and climate action plans in Southeast Michigan.

17) CREATE Resilience: Community Resilience through Education, Art, Technology, and Engagement
Nurture Nature Center · Easton, Pennsylvania
Year: 2018

CREATE Resilience: Community Resilience through Education, Art, Technology and Engagement, is a multi-disciplinary collaboration between youth and community to 1) improve environmental hazards literacy, and 2) increase engagement in resiliency actions by youth and adult residents in the Lehigh Valley region of Pennsylvania. CREATE Resilience is designed to increase community knowledge about weather and climate science, risks from local hazards, and strategies for hazard mitigation, while co-creating a vision for community resilience. Developed by Nurture Nature Center (NNC) in Easton, PA, the four-year project will work with local, state and federal partners in three hazard-prone communities in the Lehigh Valley (Easton, Bangor and Wilson areas). Hazards, particularly weather-related hazards including flooding, have had major impacts in these communities historically and recently, causing extensive damage to property and disruption to community services. Damaging river flooding along the Delaware River in 2004, 2005 and 2006 highlighted major planning and safety challenges for many municipalities in the area with high flood risk, and a recently updated regional Hazard Mitigation plan highlighted other hazards as well as the need for public education about hazards and mitigation. CREATE Resilience s advisory board will work with NNC to bring education and engagement events to teach the science of these hazards, as well as the household and community-level strategies and tools available for resilience. Partners include the National Weather Service (NWS) Middle Atlantic River Forecast Center and Mt. Holly, NJ Weather Forecast Office, and

Weather Prediction Center, as well as LV Planning Commission, Northampton County Emergency Management Agency, LV Community Foundation, Lafayette College, and FEMA Region 3 Mitigation Division. In years 1 and 2, the project will form CREATE Youth Ambassador teams, in which student interns from area high schools will meet NWS meteorologists, engage in community storytelling events, develop local hazard and resilience tours, and learn from climate and other scientists about hazards and strategies for resilience. Ambassadors will also develop and lead programming for community residents. Simultaneously, residents will participate in active-learning education events, dialogue forums, arts-based activities, technology-based programs using NOAA assets, and hands-on preparedness activities. Each community will build a collective understanding of local hazards and mitigation strategies, and co-create a vision for resilience, represented in traveling visual artist-designed murals in the third year of the project. This education and shared vision will build community support for planning and resilience and help households in making better preparedness decisions. Dissemination through Science on a Sphere and guidebooks will share the replicable model with other organizations and communities, extending the reach of the project. Close cooperation with NWS offices helps the project meet key goals of NOAA s Education Strategic Plan, related to safety/preparedness and a science-informed society. Through public events and print materials, the project will showcase and interpret NOAA-related science and data with area residents, while creating collaborative learning opportunities for youth and community to interact with NOAA scientists. CREATE Resilience also engages youth and adults in preparing for hazards, and in multi-generational learning to improve community awareness and involvement in preparedness and mitigation.

18) Empowering Climate Change Resiliency through Education in an Underserved Community

Ocean Discovery Institute · San Diego, California
Year: 2018

Understanding climate change and its exacerbating effects on local environmental phenomena (e.g., increase in frequency and/or intensity of drought, ocean acidification, water shortages, degraded fisheries) and how to create resiliency is critical for underserved communities as they are disproportionately impacted by these hazards and yet, have the least capacity to actively respond. To address this issue, Ocean Discovery Institute and its partners will build understanding of climate change and impacts on local hazards, human-nature interactions, and individual and community capacity for resilience through place-based education in the underserved community of City Heights, San Diego, CA. This project, titled Empowering Climate Change Resiliency through Education in an Underserved Community, will involve a wide range of partners, including California Sea Grant, the California Nevada Climate Applications Program, NOAA s Geophysical Fluid Dynamics Laboratory, Cabrillo National Monument, San Diego Canyonlands, RECON Environmental, Inc., and the San Diego Unified

Port District. Project activities encompass the design, piloting, and implementation of multi-grade level, integrated curricula that incorporate hands-on student climate science research, innovative solution building, and teacher professional development. This project will serve 1,500 middle school students annually and is expected to increase students understanding of scientific concepts and processes and human-nature interactions, improve their ability to make science-informed decisions, and contribute to local resilience efforts.

19) U.S. Virgin Islands Storm Strong Program
University of the Virgin Islands / Center for Marine and Environmental Studies · St. Thomas, U.S. Virgin Islands
Year: 2018

Under leadership from the University of the Virgin Islands, the Virgin Islands Marine Advisory Service, and local, non-profit, long-term, 2017 storm recovery groups, this 5-year project will create the U.S. Virgin Islands (USVI) Storm Strong Program. To date, minimal efforts have been made to engage the USVI community in hurricane education and preparation. As a result, USVI communities face significant, but often preventable, storm risks. This is the Territory s first sustained, community-based, hurricane hazard preparedness, and community leadership building program. The USVI Storm Strong Program will engage underserved and underrepresented middle- and high-school youth and their families on all of the Territory s main islands - St. Thomas, St. John and St. Croix - in a program modelled after the U.S. Climate Resilience Toolkit framework. Youth and their families will: (1) explore the science and hazards associated with hurricanes, (2) assess their communities vulnerabilities and associated risks, (3) evaluate personal and community assets and options to increase resilience, (4) prioritize and plan for events occurring before, during, and after a storm, and (5) take action, in this case, through Community Transfer Projects, which will turn the information gained through the Program into local actions to increase individual and community resilience, sharing knowledge and actions with the broader USVI community and beyond. Through this training, ~400 USVI youth and their families will be empowered as environmental leaders and change agents within their communities and important insights will be learned as to how best to engage underrepresented and underserved groups in hazard preparedness. Creation of the USVI Storm Strong Program is timely, given the significant impacts resulting from Hurricanes Irma and Maria, two Category 5 hurricanes that devastated the USVI in September 2017. These storms provide a window of opportunity to bring together partners from federal, territorial, non-governmental, academic, and the private sector, to develop a strategic, cohesive, long-term, high-impact, community-based program to improve environmental literacy and extreme weather hazard preparedness in the Territory, goals that align with the mission of NOAA’s Office of Education.
Competition: 2018: ELG for Community Resilience to Extreme Weather Events and Environmental Hazards

20) Environmental Literacy for Alaskan Climate Stewards (ELACS)
Chugach School District · Anchorage, Alaska
Year: 2018

The Environmental Literacy for Alaska Climate Stewards (ELACS) project involves K-12 Alaskan students from the Chugach School District and the Kenai Peninsula Borough School District in studies and activities to increase environmental and climate literacy and ultimately community resilience. Throughout the four-year project, students and teachers will work with scientists and experts from their communities, National Oceanic and Atmospheric Administration, Alaska Ocean Observing System, Local Environmental Observer Network, Kachemak Bay Research Reserve, University of Alaska Anchorage, University of Alaska Fairbanks, Build A Buoy Project, and Global Learning and Observations to Benefit the Earth Program. Rural Alaskan students live in some of the most vulnerable regions of the planet, areas that are highly susceptible to the impacts of climate change. Alaska has warmed twice as fast as the rest of the nation, bringing widespread impacts. Sea ice is rapidly receding, and glaciers are shrinking. Thawing permafrost is leading to more wildfire and affecting infrastructure and wildlife habitat. Rising ocean temperatures and acidification will alter valuable marine fisheries. The objectives of the Environmental Literacy for Alaskan Climate Stewards project are to provide rural, K-12 Alaska students and teachers in Alaskan Native villages with knowledge and opportunities that will help build understanding of local climate change impacts and to increase overall climate literacy and contribute to community resilience. Students and teachers will participate in first-hand experiences of environmental monitoring, data sampling through a locally relevant citizen science project, and by building ocean observation systems. The project has four main action and outcome areas: Professional development and monthly ongoing project support including school-site delivery and workshops at the NOAA Lab facilities in Kachemak Bay, Center for Alaskan Coastal Studies and Anchorage. Classroom instruction that engages the students in meaningful, innovative, place-based, project-based learning, and citizen science activities geared around site and community needs. Community Engagement which includes interviews with community members, involvement in community-based environmental monitoring, and through annual student events. Application of Knowledge Students will discuss components of the Weather and Climate Tool-Kit with community members, elders, and leaders, focusing on climate-related problems, and action planning for mitigation and adaptation. Students can share active research regarding impacts and available resources. This project will be orchestrated through the Chugach School District, which serves rural students from all over the state of Alaska through their Voyages residential, two-week phase programs, as well as the three Prince William Sound villages of Chenega Bay, Whittier, and Tatitlek, and an extensive home school services program. The coastal, native Alaskan villages of Seldovia, Port Graham, Tyonek, and Nanwalek across Kachemak Bay, in the Kenai Peninsula Borough School District will be included in this project. ELACS directly connects to NOAA s educational mission, as it will help the target population understand and predict changes in climate, weather, oceans, and coasts

through project objectives and activities. This project will promote the students stewardship and deeper understanding of their environment and the changes happening at a local and global level.

21) Climate Strong: Building Tribal Youth Leadership for Climate Resiliency
Fond du Lac Tribal and Community College · Cloquet, Minnesota
Year: 2018

Fond du Lac Tribal and Community College in partnership with the Fond du Lac Band of Lake Superior Chippewa, Great Lakes Indian Fish and Wildlife Commission, 1854 Treaty Authority, University of Wisconsin Extension's G-WOW program, and Lake Superior Estuarine Research Reserve are proud to provide the Climate Strong-Building Tribal Youth Leadership for Climate Resiliency program. Our three-year project aims to increase the knowledge and readiness of middle to high school students to deal with the impacts of extreme weather and environmental hazards that face the Ojibwe Ceded Territories (Minnesota, Wisconsin, and Michigan) and build capacity for increased climate change community resiliency curriculum in the classroom. Climate change impacts everyone, but for indigenous peoples it threatens culturally significant traditions, such as wild rice harvesting, that relies on sustainable fish, plant, and wildlife resources. These resources are critical for subsistence, spiritual and cultural needs, and treaty rights. Culturally relevant, place-based education is an important tool to involve students, in particular, underrepresented students, in developing critical thinking skills to assess the issue of community resiliency to extreme weather events and engaging in action to help resolve it. In order to achieve our objectives, we will aim our educational efforts toward youth first, as well as reaching the communities we serve. Each year, six residential youth camps (18 total) will be hosted within the Ojibwe Ceded Territories. Each three-day camp will be focused on investigating issues of community resiliency, adaption, and mitigation associated with increasing extreme weather events as well as natural environmental hazards. Camps will use place-based, experiential lessons to teach resiliency issues demonstrated by climate change effects on Ojibwe culturally important natural resources. Our project will train formal and informal educators throughout the Ojibwe Ceded Territories on how to use indigenous climate curriculum using tribal traditional ecological knowledge and NOAA assets to investigate community climate resiliency issues. Using both teacher "train the trainer" workshops and our camps, this project will create a network of formal K-12 and informal educators trained to become leaders in providing culturally relevant climate resiliency outreach to students. We will increase community resiliency literacy through six community outreach events each year (18 total) that will highlight resiliency issues facing our region and the research being done on landscape and ecological vulnerabilities through NOAA and tribal assets. Our goals are increased community resiliency literacy and adaptation of stewardship behaviors that reduce climate change impacts and increases adaptation and mitigation behaviors by our participants. These behaviors will help increase stewardship practices reducing extreme weather impacts affecting the sustainability of

culturally relevant resources, thereby preserving important cultural, spiritual, subsistence, and treaty rights practices.

22) HEARTForce: Hazard Education, Awareness & Resilience Taskforce
University of Colorado Boulder / Cooperative Institute for Research in Environmental Sciences (CIRES) · Boulder, Colorado
Year: 2018

Communities in Colorado are increasingly experiencing major disruptions from environmental hazards, such as fire, flood, drought and extreme heat. With this rise in hazardous events, there is a pressing need for communities increase their resilience. An interdisciplinary team from the Cooperative Institute for Research in Environmental Sciences (CIRES) Education & Outreach Program at the University of Colorado at Boulder is developing and implementing an innovative, action-oriented youth engagement project targeting rural Colorado students, teachers and communities. Our engagement model empowers youth i) to envision community resilience through immersive scenario-based role play based on a solid understanding of the relevant science, ii) to learn about natural hazards through engaging Colorado-focused lessons, iii) to initiate conversations about hazard preparedness from within communities, and iv) to develop and implement student-led resilience action projects. The project team is developing instructional materials for middle and high school students: four lesson plans focused on different hazards (fire, flood, drought, extreme heat), four complementary scenario-based role-play games with a focus on youth empowerment and a teacher workshop based on these materials. Each school implementation follows a sequence in which the lesson plan activities are conducted, followed by a scenario-based role play game and reflection. Building on their experience with the game, students develop resilience strategies for their community and present those at a community Resilience Expo. The project has the following three objectives: 1) Increase Colorado secondary teachers' knowledge and confidence to teach about local natural hazards, and to facilitate discussions about community resilience; 2) Increase Colorado youth's understanding of natural hazards, their community's vulnerability, and their involvement in resilience planning efforts, and 3) Enhance the capacity and empowerment of young people in Colorado to engage in dialogue with their peers, families, and community stakeholders about community resilience issues and identify, develop, and implement resilience actions. A needs assessment disseminated to Colorado teachers guides the project team in the development of all instructional materials and allows for customizing the content to teacher needs. The project evaluation explores the efficacy of the program model and studies the impact of the project activities on students and teachers. Specifically, the evaluation studies students' confidence and ability to engage in dialogue around community resilience, level to which students increase their understanding of natural hazards and resilience planning, and the ways in which teachers increase their content knowledge and confidence in teaching about natural hazards. The project fills a critical gap in Colorado's resilience planning which does not include teachers and youth. The project is guided by partners

from the NOAA RISA program Western Water Assessment, seven NOAA science advisors, Science on the Sphere collaborators, and is being implemented together with over 20 community partners, school partners and collaborators from across Colorado. Over the course of the three-year program, the project activities will train and support 140 teachers, engage 400+ students and result in 11 Resilience Expo events across Colorado, from primarily rural communities. The instructional units and the games will be used in classrooms with 600+ students.

Appendix D: Draft Resilience Education Theory of Change

Note: this preliminary draft was shared with workshop attendees on May 1st, 2019, and has since been updated. The latest version of our Theory of Change will be accessible on the Office of Education Resilience webpage starting October 1, 2019.

The Environmental Literacy Program is developing a Resilience Education Theory of Change (ToC) to serve a suite of purposes:

1) When completed, this ToC will serve as a succinct visual representation of the overarching philosophy that guides the current focus of our grants program. The ToC will be a tool to communicate our program's purpose, audiences and activities, as well as our intended outcomes and ultimate end goal.
2) The creation of this ToC would offer our current and future grantees a quick reference to assist in the conceptualization of how their local efforts contribute to a broader, national effort to increase resilience, community engagement, and civic action around current and projected environmental hazards.
3) The ToC will represent an aggregation of each grantee project funded, allowing for ELP to assess overall progress and impact to inform the creation of future funding opportunities.
4) To communicate the role of education in the larger and existing community, city, state, and federal efforts toward climate mitigation, adaptation, and resilience.

Components of a Theory of Change are the following:

- Drafted for your review:
    - Assumptions, problem statement, end goal
- Not yet drafted:
    - Intermediate outcomes, indicators, thresholds

ASSUMPTIONS

- Educators are uniquely situated to engage multiple stakeholders to address environmental, social, and economic challenges, and to explicitly connect communities to processes that enhance well-being.[2]
- Learning that extends throughout social networks, going further than the individual, can be an essential tool for increasing resilience. [3]
- Involving local members of the public leads to more effective resilience planning—such involvement is best accomplished at the community level.
- Having a knowledgeable and engaged populace puts pressure on government to address issues of community concern and improves governance and outcomes for all.
- A more environmentally literate populace makes better informed decisions, is more engaged with community-level decisions, and thereby is more resilient.

[2] Source: p.11 NAAEE Guide to Excellence: Community Engagement

[3] The emBRACE resilience framework came out a research project called "Building Resilience Amongst Communities in Europe." Source: Social Learning and the emBRACE resilience framework

- NOAA's sciences and information about climate change and resilience support informed decision making.

PROBLEM STATEMENT

Billion-dollar weather and climate disasters are becoming more frequent and costly in the United States.[4] "Climate change is playing a role in the increasing frequency of some types of extreme weather that lead to billion-dollar disasters. [Furthermore], "climate change is projected to significantly damage human health, the economy, and the environment in the United States, particularly under a future with high greenhouse gas emissions" (NCA4 2018). Climate change creates new risks and exacerbates existing vulnerabilities in communities across the United States, presenting growing challenges to human health and safety, quality of life, and the rate of economic growth (NCA4 2018).

As the problems we face in society grow more complex in nature, it is imperative that we all have the ability to understand scientific processes, consider uncertainty, and reason about the ways that human and natural systems interact make the best social, economic, and environmental decisions, that is, we all need to become more environmentally literate. Additionally, societal processes have created unequal exposure to environmental threats and access to solutions within a community. Through the process of social learning, individuals and communities can think critically and reflect upon the underlying causes of social-ecological issues, and generate solutions in a co-produced manner that address societal inequities and disparate vulnerabilities. Environmentally literate individuals, and the strengthened connections between them, are foundational to a resilient community.

END GOAL

More environmentally literate individuals and communities understanding and valuing the ecological systems where they live; making informed decisions; being civically engaged; and building strong relationships with one another that contribute to healthy, resilient, and more equitable communities.

[4] During 2018, the U.S. experienced an active year of billion-dollar disaster events including the 4th highest total number of events, only behind the years 2017, 2011 and 2016. In 2018, the U.S. also experienced the 4th highest total costs ($91 billion) only behind the years 2017, 2005 and 2012. Source: https://www.ncdc.noaa.gov/billions/

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