

Response to Comments on the Draft NOAA Education Strategic Plan

Reviewer 1

3/20/2015

public comment on federal register

I donot spport the spending involved in this plan. the fact is noaa has to choose priorities and cant be all things to all people. neither does the us public have the time, when they have to deal with 4 levels of govt corruption local, county,state,federal international - to spend in your educational fiasco.

when you have too many projects, all suffer. none are done well. none are effective. that is what is going on here. nobody in America has time for this "education". they are working 3 jobs to stay alive in private industry - are you aware of that. they have no free time to be "educated. that is why govt is getting away with so much corruption.

this is just a make work project that is gouging taxpayers for no results. also when you ask other agencies to leave the mission they were created to do to work on your mission, you are messing them up in producing their mission. this calling in "partner" is about as stupid as can be. it makes both of you not effective. if the job is worth doing, do it yourself and stop muddying up everybody elses waters.

obviously nobody at noaa is choosing a priority list. you cant do it all. but if you focus maybe you can do something well. I do not support this education program and believe it should be shut down. post it on your website for those interested inf you have info and be done with it. I believe all tax dollars for this project should be in zero amount.

how about monitoring the overfishing effectively. that is a priority for all americans who own all the fish, you let the commercial fish catchers overfish routinely. how about doing that job well. that's a job worth doing. its time for noaa to prioritize and stop sticking its fingers in every pot in the world. this comment is for the public record. please receipt.

Reply: Thank you for providing feedback on the NOAA Education Strategic Plan. We appreciate your concern about effective use of taxpayers' dollars. We will continue work hard to ensure the taxpayer continues to get good value for the resources invested in our programs.

Kim Klockow

UCAR Postdoctoral Researcher

3/21/2015

I want to note that generally, I like these goals very much! My main point of feedback would be to Goal #1 - it may be helpful to modify this to be "Science empowered society," with the text reading "An informed society has access to, understanding of, and enhanced response

capabilities due to NOAA-related services and their implications for current and future events." As this goal is society-facing, it may be relevant to link to the NOAA social science strategic plan (currently in development), which focuses a great deal on empowerment rather than merely informing.

Reply: Thank you for providing feedback on the NOAA Education Strategic Plan. We agree with the issue you raise and tried to address it in the text (line 85 - 86). We chose to use our original language for the Goal statement. We appreciate your suggestion to align our strategic plan with the social science strategic plan. Discussions with NOAA's social scientists influenced the way we handled, Goal 3, safety and preparedness, in particular, lines 433 - 440.

Carol Englander
Director, The SMILE Program, University of Rhode Island
3/26/2015

The SMILE Program (Science and Math Investigative Learning Experiences) agrees with your strategic plan. We actively work on goals 1,2,4,and 5. Goal 3 is one we will pay more attention to in future planning. The historic RI floods of 2010, closing of the hurricane barrier in response to Hurricane Sandy in 2012, beach erosion, are examples of the climate concerns that are grouped in the Safety and Preparedness category goal. Our SMILE students enjoy curricula that give them the opportunities to practical application of what they are learning in SMILE club and school to real life situations. NOAA is right on target with these strategic goals.

Reply: Thank you for providing your feedback on the NOAA Education Strategic Plan. We are glad to hear that the focus of the University of Rhode Island SMILE Program is well aligned with our strategic plan. We are interested in supporting our partners to develop and adapt programs in these subject areas. We would be happy to work with you as you explore the area of safety and preparedness.

Dr. William Rossow
3/27/2015

Throughout the document, there are numerous references to components in the education of a workforce that include "science" but not "engineering". This is especially critical for education activities that NOAA will support as part of carrying out its missions because traditional academic "science" training lacks many of the crucial skills needed in a more operational environment. Although scientific research produces knowledge, the usual academic pursuits do not concern those activities required to use this knowledge in practical applications. The usual academic "science" research stops at publications and does not result in practical instrumentation, computer analysis codes or broadly useable data products. This type of training

is more commonly provided in engineering schools/departments, which are not sufficiently emphasized in this version of the plan.

The document also lists at many places the various entities that might be partners in education and research, but these lists are exclusively national. Environmental (weather, oceans, land surface and water supply) and climate research these days is full international in scope. Working with international organizations can provide benefits far beyond the research funded nationally. Hence, the NOAA Education activities should specifically call out the need for international partnerships in the training of the workforce.

Reply: Thank you for providing feedback on the NOAA Education Strategic Plan. We agree that that NOAA's science would not be possible without engineering. Much of the agency's "environmental intelligence" is acquired through instrumentation and the role of technology and remote sensing is only expected to increase. While NOAA is primarily a science agency, we explicitly call out engineering as one of the "disciplines that support NOAA's mission" (729). We also highlight engineering in the text (see lines 140, 171, and 305) because we agree that engineering is an important part of engaging audiences.

We recognize that NOAA is an international leader in Earth system science and that international partnerships are an important part of our work. The National Marine Sanctuaries Program and the Ocean Exploration and Research Program are helping lead the way on global efforts to increase ocean literacy. We have added international partnership and collaborations to "NOAA's Educational Activities" (line 194).

Abby Peklo

**Director of Interdistrict Grants and Programs, Education Connection (B-WET Grantee)
3/27/2015**

I thought it was terrific - clear, concise, readable. I have the following suggestions/comments:

1. The term Environmental Literacy does not appear until line 22 on page 13. I think this term is important enough to appear earlier in the document.
2. Line 249 on page 11 was difficult to understand. Perhaps there is a typo or a word missing?
3. No mention of connecting non-coastal regions to coastal communities. I might add the need to educate in-lands communities about the connections between their daily lives with coastal health and resilience.

Reply: Thank you for providing feedback on the NOAA Education Strategic Plan.

1. Environmental Literacy is very important to us. In response to your comment, and the importance of environmental literacy to our work, we have added a paragraph to the introduction (lines 152 - 156).

2. Thank you for pointing out this error, we have corrected it in the text (line 260).

3. Coastal communities: Thank you for this excellent point. We agree that education and research should occur on the same scale as the system they pertain to - in this case, throughout an entire watershed. Some of the Bay Watershed Education and Training (B-WET) grantees are increasingly taking this approach in their programming. NOAA Education also embraces distance learning, which allows teachers and participants to participate in professional development and education programs remotely (see Strategy 1.E). Since the ocean and atmosphere are relevant to everyone, we agree that this is an important point and updated the text in lines 375 - 377 accordingly. We also have noted this as an idea to consider during our implementation planning process.

Reviewer 2
3/28/2015

Great plan overall.

Reply: Thank you, we appreciate the positive feedback.

Tony Rice
NASA/JPL SSA
3/31/2015

What (if any) partnering, overlap, etc is there in NOAA's educational efforts and/or vision with other federal agencies such as NASA, DOE, DOI, NPS, USGS, etc? These should be noted to at least foster cooperation between agencies with similar goals working in similar areas. Example; <http://www.nps.gov/grca/planyourvisit/upload/LightningDanger.pdf> and numerous educational resources from NASA's Earth Sciences missions.

While the Weather Ready Nation program is a great start, has NOAA considered an ambassador program made up of motivated lay volunteers and educators? NASA's Jet Propulsion Laboratory has enjoyed tremendous success with a similar program which puts enables ambassador nationwide to engage with the public on solar system exploration missions as well as other work going on within the agency. Kay Ferrari at JPL runs the program and can provide more information: Kay.a.ferrari@jpl.nasa.gov

Reply: Thank you for your comments on the NOAA Education Strategic Plan. NOAA partners extensively with NASA and other federal agencies. Partnering is a core way in which we do business (see Strategy 5.B). We co-chair the National Ocean Council Interagency Working Group on Ocean Education, serve in the Smithsonian's Waterways group, partner with NASA's Distance Learning Network, and more. We decided not to discuss our specific relationships and

partnerships with other federal agencies in the plan because we wanted to keep the document both flexible and written at a high level. Our specific interactions may evolve over time, but the philosophy of engagement, coordination, and consistent messaging with federal partners will remain a priority.

Thank you for the suggestion to expand ambassador programs. We have noted this idea to consider during the development of our implementation plan and we are grateful for the example and contact information you provided.

Emily Harrell

4/3/2015

I thought you might want to add something about data management and PARR. One of our scientists here in Panama City is looking for a repository of NOAA-funded research publications that are the result of Education Outreach programs.

I asked the NOAA Central Library if such a repository existed and they said that one doesn't exist but that the subject could become a "sub-set" in the publications repository that the NOAA Central Library is working on. Mr. Stanley Elswick is the project lead for the repository.

I also checked the NOAA Education and Outreach website to see if there is a list of publications that were the result of education outreach funding but didn't see anything. Thanks. Just thought you should know of the question and discussion.

Reply: Thank you for providing feedback on the NOAA Education Strategic Plan. You raise an interesting idea of creating a repository of publications that come from NOAA's education efforts and we appreciate you taking the opportunity to share it with us. We will consider it during our implementation planning process. We see how this idea could support Objective 5.1 (sharing our stories with leaders) and 5.4 (improving evaluation).

Dian Seidel

NOAA Research Council Advisory Member; Chair, Council of NOAA Fellows

4/2/2015

The plan is well reasoned, well articulated, and very consistent with NOAA mission goals. But it is very light on detail. Perhaps this is intentional, but it is surprising to me. Hardly any mention is made of specific programs, institutions, partners, or content of the planned educational activities. If this will be acceptable to the intended audiences, then perhaps the plan is fine as it stands. But from my perspective (internal to NOAA), the plan seems totally without substance, and concomitant commitment to concrete achievements. If (as is often done) an

"implementation plan" will accompany this "strategic plan," the former might contain the detail I seek. Without it, an interested reader might be left with unanswered questions and little understanding of what NOAA intends to undertake in this important arena.

Reply: Thank you for providing feedback on the NOAA Education Strategic Plan. We understand that you would like to see mention of specific programs, institutions, partners, and content. The decision to keep the plan light on detail about specific programs, institutions, partners and content was intentional. Due in part to the 20-year horizon required for the plan, we wanted to keep the document both flexible and written at a high level. We also wanted to avoid the issue of inclusivity - to list all programs that work in a certain area risks leaving out important contributors and often comes at the expense of readability. We intend to include additional detail about specific programs, institutions, partners and content in our implementation plan, which will outline specific actions that the community as a whole, and individual programs, will undertake to implement the goals.

Carey Tinsey

Administrative Assistant, Ocean Discovery Institute (comments forwarded on behalf).

4/6/2015

The Office of Education has been extraordinarily thoughtful about strategy and importantly, is specific about objectives relating to underrepresented groups.

Reply: Thank you, we are pleased to hear that you found the plan thoughtful and inclusive.

Reviewer 3

4/8/2015

I appreciate the draft plan and applaud its attention to diversity and inclusion. I do have two suggestions that I think are essential if NOAA is to succeed in (a) serving all communities and in (b) building a workforce that includes the currently under-represented minorities. (1) we need an implementation plan that goes beyond goals and identifies projects and programs that will accomplish the goals, and (2) the plan needs to address accountability: what specifically are we committed to and how will we measure success? What are our target numbers? What kind of workforce do we want, by what date?

The implementation plan should include discussion of best practices – how have other agencies or organizations succeeded in becoming diverse and inclusive? What programs have worked for our own agency? What are the key features of programs that work? How have previous programs changed NOAA?

It is important that we address inclusion both in our service and in our recruitment. In our programs, we should be reaching out to all American communities. As an example, the NOAA Fisheries aquarium in Woods Hole runs small intern programs for high school students – these programs are by design accessible to students from all communities, and they are evaluated annually to determine if the intern classes are diverse in terms of geography, economic background, ethnicity. All NOAA Education products should benefit citizens in all demographic groups.

The draft plan does not acknowledge that there are populations and communities that have historically been invisible to NOAA. How might NOAA work with HBCUs and MSIs and the communities their students originate from to begin to serve and to recruit from these communities? Attention and commitment to diversity and inclusions should be evident and an expression in each of the plan goals.

Reply: Thank you for providing detailed comments and suggestions on the NOAA Education Strategic Plan. We appreciate your attention to diversity and accountability. We will develop an implementation plan to accompany this strategic plan. This document will have a two-year horizon and will be revisited annually. We are committed to measuring and reporting progress, but given the 20-year lifespan of this Strategic Plan, decided not to include specific targets or milestones in this document.

We are working in new ways to address the issues you raised. For example, the NOAA Education Council recently established a Diversity and Professional Advancement Working Group (DPAWG). The DPAWG is collecting information about the demographics and experiences of underrepresented groups in the NOAA workforce. This analysis will inform strategies about building our future workforce, identify barriers to participation and advancement in NOAA careers, and help NOAA's workforce, from entry-level to leadership positions, better reflect the diversity of the Nation.

The Office of Education is conducting an evaluation of the Educational Partnership Program and Hollings Scholarship Program to understand the contributions of these programs in terms of the number of students, particularly from underrepresented groups, graduating with degrees in disciplines that support NOAA's mission. Addressing underrepresentation is a major undertaking, and while we are already making strides, we have a long way to go to reach our goals.

Best practices: We agree that we need to continue to identify best practices and work to implement them across NOAA. We are currently conducting interviews with NOAA programs that have been successfully reaching underserved audiences with the intent of learning about best practices that can be scaled up across the agency. We would be pleased to have additional input from you as we move forward.

Historically invisible communities: This is an important issue. We know we have a lot of work to do in this area. The plan does address this issue in several ways. We adopted Objective 5.5,

which is focused on underserved audiences, and in Goal 3 we recognize that underserved communities are often most vulnerable to environmental hazards. HBCUs and MSIs are valuable partners for this work, and we highlight the role they play in accomplishing Goal 4 in Strategy 5.C.

Maggie Mooney-Seus

Communications Program Director, Alaska Fisheries Science Center

4/9/2015

1. The structure of the plan is organized. The introductory/background text provides clear rationale for identifying the Goals, Objectives and Strategies.
2. Suggest changing heading “Evidence of Progress” at the end of each section to Evaluation or Measuring Performance. Using one of the latter terms makes it clearer that this is how you are going to measure success or progress in achieving each objective and goal. The phrase Evidence of Progress is a bit misleading -- seems to suggest that you are going to include some examples of where progress in achieving these goals and objectives has been made.
3. Glad to see included in the end of the plan a section on how progress will be evaluated and monitored. It is also good to see that there will be annual reviews of the Strategic Plan and that these reviews will be used to make adjustments to the plan as needed. It is important for a Strategic Plan to establish a vision and direction for the agency’s education activities but that it be adaptable and responsive as progress is made toward achieving various objectives.

Reply: Thank you for reviewing the draft NOAA Education Strategic Plan and providing comments to us.

- 1. We are pleased to hear that you find the plan clear, well-organized, and evaluable.*
- 2. We understand that you feel the term “evidence of progress” is unclear. “Evidence of progress” is a term used in NOAA’s planning documents. We hope that sentence preceding the evidence of progress statements (“Over the next 5 years, NOAA education will have...”) clarifies the definition to readers.*
- 3. We agree that measuring and tracking progress is very important. We are pleased that you found our efforts to highlight this effective.*

Chris Bowser

Education Coordinator, Hudson River Estuary Program and Hudson River National Estuarine Research Reserve

4/10/2015

Thank you so much for the opportunity to review NOAA's insightful strategic plan. As a NOAA affiliated educator, I found the document to overall be excellent and well thought out. Actually, I'm glad I read the whole thing because it gives me good ideas for our own Reserve's strategic planning process.

I was especially glad to see the "social, economic, and environmental" perspectives laid out in line 73, as well as the distinct mentions of citizen science in lines 182, 284, and elsewhere. I appreciate the value given to environmental education throughout, and the recognition of the Reserve system.

The Goals (lines 211-226) are broad enough to capture a lot of what we do and need to do, which I like. I think that Goal 3, "Safety and Preparedness" will be one of the most challenging and an area that I hope NOAA will continue to provide guidance and opportunities for feedback. It will be a bit of a lift to get students and teachers to address the issues off safety, hazards, etc, especially when one of our biggest challenges is convincing people its OK to get outside and explore their estuaries.

The overall document, especially the opening summaries, certainly put climate change and resilience at the forefront of our collective mission. I completely understand and support that, but I also wonder if important issues that may have indirect links to climate change are minimized; topics like overfishing, habitat degradation, invasive species, watershed inputs, waterfront development and access. Yes, we can link all these topics in some way to resiliency and climate, but these issues also have aspects unique to themselves. I think the overall document provides plenty of "room" to address these topics, but the summary material is very focused.

Reply: Thank you for taking the time to comment on the NOAA Education Strategic Plan. We are glad to hear that you found the Plan well thought out and we hope it is useful for the National Estuarine Research Reserve planning efforts. We have noted that you consider social, economic, and environmental perspectives as well as citizen science priorities. We agree that Goal 3 - Safety and Preparedness will likely be a challenging area and we will consider your suggestion to provide guidance and opportunities for feedback during our implementation planning process.

Climate and resilience: We agree with your concern that topics like overfishing, habitat degradation, invasive species, watershed inputs, waterfront development and access deserve more emphasis than they got in the draft strategic plan. To address this issue, we incorporated those topics into the introductory text for Goal 2 (388 – 389). In addition, we intend to convey the larger story of environmental issues through photographs in the final version of the strategic plan.

Carol Ann Lobo Johnson
National Education Partnerships, Young Minds Inspired

4/9/2015

One overarching thought pertains to Goal #2 Conservation & Stewardship . I would like to suggest that you incorporate more "up stream" thinking. I appreciate that as it says in line #354 "NOAA's stewardship and conservation programs are often based in the coastal areas." But the health of coastal areas and marine estuaries and lakes often relies on what happens "up stream." Just as you wish to engage the public early in decisions and actions, it is also important to address what happens "up stream."

So maybe the objective is coordinate efforts with the USDA and the EPA and other governing bodies that are responsible for the water that finds its way to the marine estuaries, etc.

Reply: Thank you for taking the time to provide input on the Education Strategic plan. We agree that reaching people in upstream and inland areas is important. We agree that education and research should occur on the same scale as the system they pertain to - in this case, throughout the entire watershed. Some of the Bay Watershed Education and Training (B-WET) grantees are increasingly taking this approach in their programming. NOAA Education also embraces distance learning, which allows teachers and participants to participate in professional development and education programs remotely (see Strategy 1.E). Since the ocean and atmosphere are relevant to everyone, we agree that this is an important point and updated the text in lines 375 - 377 accordingly. We also have noted this as an idea to consider during our implementation planning process.

Kristen Yarincik

**Director, Research & Education Programs; Director, National Ocean Sciences Bowl,
Consortium for Ocean Leadership**

4/10/2015

Representing the leading oceanographic research and education institutions, the Consortium for Ocean Leadership's mission is to shape the future of ocean sciences. Ocean Leadership ardently supports NOAA's education mission, as the ocean scientific community as a whole—not only NOAA—benefits from a Science-Informed Society and growing and training our nation's ocean science Future Workforce.

Ocean Leadership and its members represent a network of partners available to NOAA to implement the education strategic goals, and we appreciate the opportunity to comment on the draft update of the NOAA Education Strategic Plan 2015-2035: Advancing NOAA's Mission through Education (Draft Plan). We commend the agency for the Draft Plan's interrelated goals that cut across NOAA's mission and line offices, as well as for the streamlined objectives and consistent evaluation metrics.

We are particularly interested in partnerships and diversity, which permeate the Draft Plan, and the Future Workforce, and Safety and Preparedness goals. The emphasis on partnerships is important, and we encourage the Education Council to think broadly about how partnerships

can continue to be used in implementing this strategy. The Final Plan should highlight the importance of competitive grants as a strategy for building and maintaining partnerships that have proven valuable in helping NOAA meet its education goals and objectives. The National Ocean Sciences Bowl (NOSB) is a program managed by Ocean Leadership and one successful example of a partnership funded through NOAA's education competitive grants process. This partnership supports all of NOAA's objectives under the Draft Plan's Education Goals 1 (Science-Informed Society), 2 (Conservation and Stewardship), and 4 (Future Workforce). NOSB has engaged more than 27,000 U.S. high school students and educators since 1998 and has built a collaborative learning environment in partnership with more than 35 U.S. academic and research institutions, professional associations and societies, and ocean-related companies. The result of this competitive grant-based partnership is an expansive community that gains a broad and deep understanding of mission-related science and policy, an appreciation for our marine resources, and exposure to NOAA's assets and the workforce opportunities within NOAA and its partners.

The need to engage youths and adults from diverse backgrounds in ocean science research, education and literacy opportunities through NOAA's education efforts cannot be overstated. This is particularly challenging, as the ocean (beyond the beach) is difficult to access for many and therefore a remote idea rather than part of an everyday experience. However difficult, this engagement is critical for ensuring vulnerable communities are prepared for severe weather and environmental disasters, as well as for building a strong ocean and atmospheric science workforce that represents our nation's diversity. Unfortunately, it should be noted that the Draft Plan does not identify strategies specific to increasing diversity. We recommend NOAA create programs and opportunities that build on and scale successful local approaches; enable existing partners to incorporate targeted efforts to reaching underrepresented populations into their activities; and support a continuum of opportunities that enable a student to stay engaged as he or she progresses through school. In doing this, students (and their families) must be engaged at a young age, before career expectations are set, and we suggest that more diversity-focused programs be undertaken at the K-12 level. NOAA's assets provide an ideal toolbox for hands-on experiences proven successful in engaging students in STEM. Relevant assets also exist within the academic, research, and industry sectors; and these additional assets, in partnership with NOAA, are important for leveraging opportunities to engage students and educators. There are many examples within the NSF-supported Centers for Ocean Sciences Education Excellence (COSEE) and a local exemplar in the annual teen conferences of the Ocean Institute. Additionally, the agency should facilitate greater collaboration between NOAA-supported programs in this area. For example, the NOAA Enrichment in Marine Science and Oceanography (NEMO) program successfully (and symbiotically) leverages the NOSB in its efforts to teach students the marine sciences. As part of the education program, NEMO students prepare for and participate in the NOSB's regional competition, enhancing their educational experience while helping each program meet its goals. This model of mutual collaboration and leveraging of NOAA-supported education programs is replicable and can be deployed in all parts of the country where NOAA laboratories and NOSB regional competitions coincide.

Within the Future Workforce goal, we recommend that the Final Plan includes an objective targeting training for active scientists, particularly early career scientists. NOAA's Sea Grant Knauss Fellowships are an excellent example of training opportunities for marine science graduate students interested in resource management and policy; however, marine scientists of all levels would benefit from training in how to effectively communicate science to the stakeholders who need it. While the language of this goal specifically indicates that the audience includes students, educators, researchers, policy makers, managers, and institutions, it is not reflected in the objectives (p. 22, line 518). The NSF-supported Marine Geosciences Leadership Symposium is an example of training for early career scientists in science communication, policy, leadership, and interdisciplinary collaboration. Successful models like these can be leveraged, expanded, and customized to support NOAA's workforce needs and target goal audiences not identified in the current objectives.

Goal 3 specifically underscores the importance of educating individuals and communities in order to enhance the nation's capacity for safety and preparedness. The objectives and strategies of Safety and Preparedness should reflect that industry, state agencies, local governments, tribes, and non-government organizations represent important audiences for this goal.

Lastly, the Draft Plan clearly outlines NOAA's educational strategy; however, other federal agencies support activities that complement this plan or can be leveraged to ensure federal dollars are spent effectively, e.g., Organizational Excellence across agencies. We encourage NOAA (and the other federal agencies) to take advantage of the National Oceanographic Partnership Program, the National Ocean Council, and other interagency forums to share information and identify opportunities to maximize assets and resources.

In closing, we strongly support this update to NOAA's Education Strategic Plan and look forward to working with the Education Council for any needed development and inclusion of these recommendations in the Final Plan.

Reply: Thank you for taking the time to provide comments on the NOAA Education Strategic Plan. We greatly value our partnership with the National Ocean Sciences Bowl and more broadly with the Consortium for Ocean Leadership. We agree that competitive grants are an important tool for NOAA Education. We highlight grants as one of NOAA's educational activities (line 189) and include them throughout the document when referencing partners and "NOAA-supported" programs.

Thank you for highlighting the importance of reaching diverse audiences. We wrote Objective 5.5 to address this concern. We will track progress on this issue through the evidence of progress statement 5.5a. "Developed a coordinated portfolio of products, programs, and partnerships that target underserved audiences." We welcome additional thoughts and suggestions from the NOAA Education community and our partners on how to achieve this objective.

Thank you for highlighting the importance of communications training for scientists. We concur that this is a valuable investment. We have noted this as an idea to consider during our implementation planning process.

Goal 3: We agree that industry, state agencies, local governments, tribes, and non-governmental organizations are important audiences. We have expanded the list on lines 452 - 455 to highlight the sectors that you mentioned. Although we do not list them by name in the strategies, we do consider the audiences you mentioned as “partners” throughout.

We agree that organizational excellence applies across agencies. NOAA partners extensively with other federal partners, and this is a key way in which we do business (see Strategy 5.B). We co-chair the National Ocean Council Interagency Working Group on Ocean Education, serve in the Smithsonian’s Waterways group, partner with NASA’s Distance Learning Network, and more. However, there are still ways in which we could improve our coordination with federal partners. We have noted this as a priority to consider during implementation planning.

Paul Miller
Senior Hydrologist, NOAA Colorado Basin River Forecast Center
4/10/2015

Thank you for the opportunity to review NOAA’s Education Strategic Plan for 2015 – 2035. The current draft provides a quality high-level overview of what the NOAA Education council aims to achieve. We do have some general comments and questions regarding the draft. They are listed below.

As informal educators in a NOAA field office, we would like to see more emphasis on communication in the education plan. We think the plan lays out an important path forward towards advancing NOAA’s educational goals, but we think there could be a more explicit emphasis on communicating the goals and the results going forward. Beyond the “NOAA Education Annual Accomplishment Report”, by what avenues will progress of NOAA Education programs be communicated within NOAA and outside of NOAA (to external partners and the general public)? Some of our specific comments below may help address this point.

While the efforts outlined to participate with K-12 education in this report are extensive, we noticed a lack of university participation/collaboration. The report cites that 78% of university STEM students express an interest in STEM fields prior to entering college, but the other 22% of students is still an important target audience. These “undecided” students should be exposed to the work NOAA is doing and possible career paths. Even if the students do not enter a traditional STEM field, NOAA will need proficient communicators to bridge the gap between NOAA, the general public, and policy makers.

Reply: Thank you for commenting on the Draft NOAA Education Strategic Plan. We appreciate your interest in understanding our strategy for communicating NOAA's education accomplishments and progress on the strategic plan and we welcome your suggestions. We are continually refining the way we collect and share accomplishments. We have noted this as a point to consider during our implementation planning process.

Universities are major partners for NOAA Education and reaching university students is an important component of our work. For example, we have strong partnerships with the universities and students that participate in the Cooperative Science Centers, Cooperative Institutes, and Sea Grant programs.

With regard to communication, we include the type of role that you discuss - preparing communicators to bridge the gap between NOAA, the public, and policymakers - in "disciplines related to NOAA's mission" and recognize that even when engagement and career exploration do not result in a student directly pursuing a degree, they do promote scientific literacy.

Manuel Alonso
Executive Director, Earth Team, B-WET Grantee
4/10/2015

As a nonprofit environmental education provider working with over 100 schools and over 50,000 students in the past 15 years, we have read with genuine interest NOAA's education plan. We are currently implementing the third year of a NOAA B-WET funded project and we have valuable lessons from the field to share. We currently have special interest in 1.D. "Promote and Coordinate citizen science opportunities" and what we are learning in this important area, at a time when we see so many attacks on the value of science.

Our programs combine formal and informal education. We help develop curriculum with many schools in the Bay Area and their California Partnership Academies, and our objective is to improve underrepresented student's understanding of the importance of science and their exposure to environmental jobs and careers. We have found NOAA's educational resources to be first-class and extremely useful.

However the strength of our programs resides in the after school space and in informal education settings. We strongly agree with lines 279 to 285 that this is a uniquely situated space playing a critical role as a free-choice learning environment. However we also feel that this space lacks resources, public schools do not always understand its importance and it needs better coordination with school-districts and decision makers with specific support from NOAA. Is in this space that most of our citizen science opportunities happen, where youth have access to field events and the opportunity to collect and use data. We strongly believe that hands-on, face to face collaborative learning opportunities between students, the public and experts is an effective tool towards a science-informed society.

We welcome NOAA's understanding and emphasis on the importance of informal education and we look forward to seeing Goals 1 and 2 of the Education Strategic Plan materialize in further collaboration opportunities with NOAA's pool of experts participating in informal education settings as well as specific after school or "expanded learning" funding opportunities with schools districts (such as West Contra Costa USD) that are willing to invest in this important space and collaborate with environmental education service providers such as Earth Team that specialize in this informal education space.

Congratulations to NOAA on a well thought, excellent document. It is reassuring to see NOAA's professional staff moving forward into the future with such clarity.

Reply: Thank you very much for taking the time to comments on the plan. We are pleased to hear that it resonates with you. We agree that there is a lack of resources for after school and informal education and we will keep this in mind as we develop our implementation plan.

Nancy Rabalais
President, National Association of Marine Laboratories
4/10/2015

The plan clearly addresses how and convincingly justifies why NOAA invests in education to expand the public's understanding and stewardship of Earth systems – in accord with the America COMPETES legislation of 2010. The vision is to have an informed society that uses ocean, coastal, Great Lakes, weather, and climate science to make the best social, economic, and environmental decisions. NOAA's strategy to work across the agency while seeking significant input on education from external partners will be a productive structure to follow. This strategy has proven productive, as demonstrated by NOAA's existing research collaborations with academic institutions, such as the National Sea Grant Program, cooperative institutes, the National Estuarine Research Reserve System, and multiple NOS extramural funding opportunities.

NAML, in its current and continuing Public Policy Agendas, strongly supports recommendations made to the NOAA Science Advisory Board that calls for continuing strong support for NOAA extramural programs. This recommendation extends to the extramural education community as well given its ability to incorporate NOAA-funded science results into educational programs that support NOAA's mission

The Role of Marine Laboratories in the Nation's Education Enterprise
NAML's marine laboratories, distributed along the U.S. oceans, coastal and Great Lakes systems, form a unique complex of place-based "windows to the sea." They connect research communities with cutting edge marine, coastal and social sciences, while also providing students and citizens with meaningful learning experiences. The members of NAML work

together to improve the quality and relevance of ocean, coastal and Great Lakes research, education and outreach. In particular, NAML laboratories serve a unique role in researchers and educators encourage the wise use and conservation of marine and coastal habitats and resources using ecosystem-based management approaches. NAML laboratories and their education staff members focus many of their programs on the education and training of the future scientific and technical workforce. They also play a major role in increasing the public's literacy of the oceans, coasts and the Great Lakes with an ultimate goal of promoting greater environmental stewardship.

NAML finds it to be critically important that we improve ocean literacy and workforce development among all sectors of our nation. Marine laboratories play an important role in formal and informal education and workforce development by providing students with a place to learn. Marine laboratories serve as primary training grounds for experiential ocean education and are committed to enhancing diversity within the field of ocean, coastal and Great Lakes research and education. By fostering relationships with community colleges and minority-serving institutions, marine laboratories provide distinctive learning opportunities for underrepresented groups, allowing students to achieve a greater understanding of oceans and coastal ecosystems and providing them with a sense of stewardship.

The unique and important aspects of marine laboratories are illustrated and heralded by two recent important reports from the National Research Council. They are: Sea Change: 2015-2025 Decadal Survey of Ocean Sciences (DSOS); and Enhancing the Value and Sustainability of Field Stations and Marine Laboratories in the 21st Century.

Engagement

NAML laboratories are well-positioned to help NOAA meet many of its education objectives, in particular:

- Creating opportunities for individuals to become involved in NOAA research through citizen science, place-based education, hands-on experimentation, and training,
- Supporting the development of literacy frameworks that outline the fundamental concepts of Earth system science,
- Interfacing with and engaging Minority Serving Institutions,
- Providing professional development opportunities for educators, and supporting educator networks, and.
- Training the next generation of scientists and managers to recharge NOAA's workforce

We look forward to the continuing emphasis by NOAA in extending its science mission through effective education programs, and are prepared to join in these efforts.

Reply: Thank you very much for taking the time to provide comments on our strategic plan. We greatly value the expertise, infrastructure and dedication of the marine laboratories and deeply appreciate the support for NOAA education they provide. We look forward to working with you in partnership to leverage resources and make progress toward our common goals.

Maya Carson
Watershed Program, Cycles of Change
4/10/2015

1) As a watershed educator in K - 12 schools I am pleased and grateful to read this document. I have read it carefully and have only found integrity and inclusivity in it's contents. These are both values that I, and those I work with, hold in high regard.

Thank you for this carefully and intelligently written document.

Reply: Thank you for taking the time to read and comment on our plan. We are pleased to hear that you found it inclusive and thoughtful. Thank you for the good work you do.

Reviewer	Original line	Comment	Action	New line	Change	Response
Tony Rice	74	Line 74+: I'd like to see some mention of empowering the nation to be better consumers of weather and climate forecasts and data in general. Weather data is everywhere and this will only increase over the next 20 years. The public understands what NOAA and especially the NWS produce, the audience each product is intended for, and how to access it is critical to the informed society that the vision (line 71) speaks of.	Accepted with modifications	85 – 86	Added "empower" to introductory paragraph.	We have accepted the suggestion to highlight "empowering" the nation, but we avoid specific mention of weather data to include other topic areas as well.
Maggie Mooney-Seus	79	A noticeable gap in NOAA's Education Mission is that there is no mention of our role as a regulatory agency. National Marine Fisheries Service is under the NOAA umbrella. It not only has a key role in providing "the best available science" but also has a regulatory responsibility to manage fish resources and monitor protected species such as whales, dolphins, sea turtles and seals. This should be reflected in NOAA's Education Mission. Lines 79 and 80 should be amended as follows: "NOAA is charged with helping the Nation sustainably manage its use of living marine resources and understand and predict changes in climate, weather, oceans, and coasts."	Accept with modifications	79 – 80	Added "engaging society to support informed decisions through an understanding of Earth system sciences."	We agree that marine resource management is an important part of NOAA's mission. We broadened this section to focus on supporting informed decision-making. Specific fisheries related issues are included on line 147 and 148.
Paul Miller and Stacie Bender	85	Suggest adding the words "and communicate" between "respond" and "accordingly".	No change			We consider communication to be integrated in this process, but we choose to focus on the end-state.
Carey Tinsey	92	The word "including" could be "and ensuring" as the general public would include underrepresented groups but I think the intent is to be specific that this is a priority.	No change			We cannot alter this language because it is part of a quote from the America COMPETES Act.

Maggie Mooney-Seus	152	Under the heading NOAA's Unique Role in Education and the bullet that is entitled NOAA's Topics in the second sentence (line 152) should be amended to include the phrase "marine resource management." The sentence would read "NOAA is an international leader in ocean, coastal, Great lakes, weather and climate science and marine resource management." The rationale for suggesting this amendment is because we have some of the most well managed fisheries in the world. We have recovered several marine mammal stocks from the brink of extinction. This is not reflected in the document as written.	Accepted with modifications	157 -159	Added "science, service, and stewardship."	We agree that marine resource management is an important part of NOAA's mission. We broadened this section to focus on science, service, and stewardship. Specific fisheries related issues are included on line 147 and 148.
Maggie Mooney-Seus	214	Line 214. Would like to see Goal 2: Conservation & Stewardship modified to better capture the need for the public to not only understand that science is core to the agency mission but also that science supports our marine resource management decisions. More importantly, that they, the public, as part of their conservation and stewardship role, should more actively engage in the resource management decisions when they have the opportunity to do so. The beauty of the Magnuson-Stevens Fishery Conservation and Management Act, unlike most of our federal environmental laws, is that it provides a platform for the public to engage. Part of our education mission should be to make the public aware of these opportunities – that they have voice in marine resource management decisions.	Accepted with modifications	388 - 389	Added sentence describing the role of these mandates.	We consider resource management to be a core component of both conservation and stewardship. We frame our Goal 2 discussion around the conservation laws that NOAA is charged with enforcing (lines 347 - 345). We appreciate the perspective that the Magnuson-Stevens Fishery Conservation and Management Act provides a platform for the public to engage in this process, and we have included a statement describing this role in the plan. However, Magnuson-Stevens is not the only mandate like this - the National Marine Sanctuaries also call for public engagement in their management councils - so we keep the reference general (lines 385 - 386).
Maggie Mooney-Seus	215	Suggested rewrite for lines 215-216: Individuals and communities participate in the marine resource management process and are actively involved in stewardship behaviors and decisions that conserve, restore, and protect natural and cultural resources related to NOAA's mission.	No change			We consider resource management to be a core component of both conservation and stewardship. Throughout the document, we strive to keep the plan concise and avoid listing topic areas. If we were to add topic areas to the goals, they would become very long with little commensurate gain in clarity or substance.

2015 NOAA Education Strategic Plan Response to External Review

Paul Miller and Stacie Bender	222	Line 222 – Add “To build” at beginning of statement and add “that” after workforce.	No change			We chose to write goals to reflect end states, not “to do” actions. The introductory verb tends not to add much concrete information to the statement - in other words, it would have the same meaning whether we said promote, develop, foster, etc. We prefer the more concise end-state format.
Carey Tinsey	239	It may be helpful to include “society” and “individuals and communities” in glossary to clarify the distinction of their meanings.	No change			We use the conventional, dictionary definitions of society, individuals, and communities, so we chose not to define them. We provide a definition for terms like “youth and adults” because we use them in evaluation, so a more precise definition is important.
Abby Peklo	249	2. Line 249 on page 11 was difficult to understand. Perhaps there is a typo or a word missing?	Corrected	260		
Carol Ann Lobo Johnson	249	Minor comment: The definition of “objectives” in line 249 is unclear. Perhaps a word (verb) is missing?	Corrected	260		
Dian Seidel	249	Line 249 -- “. . .of NOAA’s. . .”	Corrected	260		
Paul Miller and Stacie Bender	274	We feel the Nation’s universities should be involved in the development of a science-informed society in addition to K-12 schools.	Accepted	285, 289 - 291	Deleted “K-12,” added sentence about universities	Our university partners play an important role in developing a Science-Informed Society. We have deleted “K-12” to have this statement include higher education.
Tony Rice	279	Education is critical to the goal of an informed society. Citizen science is a growing aspect of this. This document should more clearly outline how NOAA values and intends to incorporate citizen science into educational and research efforts. Suggested strategy update. 1.D Engage educators and the public through citizen science opportunities, make clear how collected data will be used to improve NOAA and other scientific organizations	No change			We appreciate the feedback that citizen science is a priority. NOAA has a unique opportunity to promote citizen science. Given the complexity of our strategic plan, however, we do not have the opportunity to delve into much detail in any particular area in the strategies. We will consider the growing importance of citizen science as we develop the implementation plan.

2015 NOAA Education Strategic Plan Response to External Review

Paul Miller and Stacie Bender	289	I think it would be helpful to describe where and when NOAA experts will “meet with groups of students and professionals.” For example, meet with students and professionals in high school during junior and senior years? At University “Meet your Major” fairs? More specific examples would be helpful.	Accepted with modifications	305	Added "engineering challenges"	We added one example to expand the list of activities. The purpose of this paragraph is to give a small sample of the various ways in which NOAA staff engage in education activities in local communities. Given the complexity of our strategic plan, we do not intend to be exhaustive.
Maggie Mooney-Seus	303	Under Objective 1.1, lines 303-304 should add phrase “and management actions.” Sentence would be amended as follows “1.1. Youth and adults from all backgrounds improve their understanding of NOAA-related sciences and management actions by participating in education and outreach opportunities.”	No change			As we describe in the Plan Overview section, Goal 1 is foundational to Goals 2- 4. In Goal 1, we focus on the science that underpins NOAA's work. In Goal 2, we build on that area to specifically address how science is applied to conservation and stewardship decisions and actions, including those related to marine resource management. Therefore, we do not include this level of detail in the objectives for Goal 1.
Maggie Mooney-Seus	307	Under Objective 1.3, lines 307-308 should be amended to capture management aspect of what we do. Sentence would read “1.3 Formal and informal education organizations integrate NOAA-related science and discussion of resource management content in, and collaborate with NOAA scientists and managers on the development of”	No change			We consider resource management to be a core component of both conservation and stewardship. We keep the plan light on detail. If we were to add topic areas to the objectives, they would become very long with little commensurate gain in clarity or substance.
Paul Miller and Stacie Bender	310	Currently, there is no mention on collaborating with university partners in the strategies section; the Nation’s university system could be a really important partner in this effort and should be included in the strategies section.	Accepted	285, 289 - 291	Deleted “K-12,” added sentence about universities	Working with university partners is an important part of what we do. Universities are considered "partners" and so we feel they are included in the strategies. However, to highlight this role, we have mentioned them in the text as well.
Maggie Mooney-Seus	315	Lines 315-316 should be amended as follows “1.B. Partner with informal education institutions and organizations to showcase and discuss NOAA-related science, data, discoveries and marine resource management.”	No change			We consider resource management to be a core component of both conservation and stewardship. We keep the plan light on detail. If we were to add topic areas to the strategies, they would become very long with little commensurate gain in clarity or substance.

2015 NOAA Education Strategic Plan Response to External Review

Maggie Mooney-Seus	325	Line 325, 396, 464, and 542 - Evidence of Progress: to say just "more" "increased" "expanded"... seem like vague benchmarks? If the goal is to include those definable metrics/criteria in implementation plans, that should be stated earlier in the document.	No change			The NOAA Education Strategic Plan does not include specific benchmarks in part because of the 20-year horizon of the plan, as we need to maintain flexibility over time. We intend to include more details in our implementation plan, which will outline specific actions that the NOAA Education community as a whole and individual programs will undertake to implement the goals of the new plan.
Maggie Mooney-Seus	364	Under Conservation and Stewardship Goal, line 364 should be modified to include the broader list of stakeholders we work with “co-managing natural resources with Native and commercial and recreational fishing groups. “	No change			These are indeed important partners. The focus of this paragraph is native groups, so adding other partners here disrupts the organization and flow. Commercial groups are addressed with "industry" and recreational opportunities are covered in "resources they use and care about." Following a previous comment, we added more language talking about engaging people in this process, which also addresses this comment.
Reviewer 2	409	Add the word ‘water’ after the word weather since NWS is heavily involved in addressing flood and drought threats.	Accepted	427		
Paul Miller and Stacie Bender	427	It is important to mention the role of communication of severe weather threats in addition to the integrated STEM education. The role of communication, and how people respond to it, cannot be understated.	Accepted with modifications	460		We expand the role of understanding audiences and effective communication in lines 433 - 440 and specifically mention communication in line 461.
Reviewer 2	431	Add the word ‘hydrology’ after the word meteorology since NWS hydrologists can help provide key forecasts and travel times during oil spills impacting rivers and provide critical forecasts of flooding from heavy rains associated with hurricanes.	Accepted	460		
Tony Rice	445	Please consider adding the following objective to goal 3: Youth and adults from all backgrounds improve their understand NOAA products. Develop and support opportunities for youth and adults to understand and make better use of NOAA products.	No change			Getting audiences to use our products is a core piece of this goal. However, we feel that “use” is implied in the objective statements. Accessing information, responding appropriately, and integrating science all involve use of products.

2015 NOAA Education Strategic Plan Response to External Review

Paul Miller and Stacie Bender	447	The “appropriately respond” term is key to the Objectives section. I would like to see a stronger tie to appropriate response in the following “Strategies” section. More detailed information about “appropriate response” would further emphasize the role of communication within in the document.	No change			Objectives include the end-state, i.e. an appropriate response. Strategies articulate how we will work to make this happen.
NWS Warning Coordination Meteorologist in FL	470	I really like the Evidence of Progress below and hope there can be some progress from a national level working with the States. Working with Florida School Districts at a WFO level has been a challenge. Teachers here are forced to teach to the Florida Comprehensive Assessment Test (FCAT). The only day I can get into public schools is during the Great American Teach-in. Expanded partnerships that lead to increased integration of safety and preparedness information into curricula, exhibits, and programs.	No change			We are pleased to hear that the evidence of progress statements resonate with you. We have noted your comments as a challenge to consider for educators integrating our materials. We will consider your comments as we develop the implementation plan.
Paul Miller and Stacie Bender	473	See previous suggestion to revise Goal 4 (page 10, lines 222-223).	No change			We address these areas in the objectives for Goal 4.
Carey Tinsey	509	Consider adding low socioeconomic status as this is now a definition being used more broadly (including NSF).	No change			We have noted this as a priority to consider for implementation and understand the importance of reaching individuals from low socioeconomic status. This is part of our effort in Objective 5.5, about reaching underserved audiences. In Goal 4, our mandates and data specifically related to underrepresented minorities.
Christos Michalopoulos	526	Can objective 4.4 be expanded to better incorporate the Education Council's Diversity and Professional Advancement Working Group?	Accepted	567 - 568	Added "advance in careers"	The Diversity and Professional Advancement Working Group makes a major contribution to Goal 4 so we have expanded Objective 4.4 to better capture their work.
Maggie Mooney-Seus	556	Under Goal 5: Organizational Excellence, amend line 556 to include word “resources.” Sentence would read as follows: “...resilient resources, communities and economies,”	Added "ecosystems"	596		"Resilient ecosystems, communities, and economies" is consistent with NOAA's vision. Marine resources, like several other NOAA topics, cut across all three.
Paul Miller and Stacie Bender	561	Insert the word, “to” in between “mandate” and “all”.	Corrected	601		

<p>Paul Miller and Stacie Bender</p>	<p>569</p>	<p>The section related to “Goal 5: Organizational Excellence” discusses coordination of NOAA education efforts by the NOAA Education Council and includes the statement “The Education Council ... increases capacity for NOAA educators...” (lines 569-570). In that statement from the section on “Goal 5”, does “NOAA educator” mean a NOAA scientist who works on education and outreach projects? Or, does that term mean a formally trained educator who uses NOAA resources? Are there any plans to encourage NOAA scientists to learn about Education as a field itself, perhaps through online training modules or other professional development opportunities? NOAA scientists who collaborate with educators external to NOAA are certainly building valuable partnerships. Emphasizing ways in which NOAA scientists can more thoroughly understand the education process itself may make those collaborative partnerships between scientists and educators even more productive and beneficial, ultimately to the students and the general public served by NOAA.</p>	<p>No change</p>			<p>NOAA educators and the NOAA education community include all who engage in education activities in NOAA, even if education is not in their job title or primary duties. Training scientists and others to be more effective educators is an important point. We will consider this during our implementation planning process.</p>
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<p>Paul Miller and Stacie Bender</p>	<p>660</p>	<p>In the “Program Evaluations” section, the draft states, “Individual programs, units, and offices are responsible for evaluating and improving their own programs.” This statement seems a bit contrary to the previous message of being consistent. For these types of programs, there should be flexibility to adjust to each unique situation, but there should be some consistency in the evaluation of programs. If a particular metric does not apply in a situation, reasoning should be given, and leeway should be provided such that those reasons can be accepted. There should be at least an effort to apply common metrics, even if each of the common metrics does not fit every situation. We understand that measurable results are necessary in program evaluation but that such results can sometimes be difficult to quantify. We would like to know if there are any particular methods/rubrics that will be used to provide evidence of progress, especially with respect to the more abstract objectives. A few specific examples of (or references to) evaluation methodologies, rubrics, and/or metrics would be very helpful.</p>	<p>No change</p>			<p>We are coordinating data input through monitoring and evaluation framework. However, most NOAA education activities are part of standalone programs with specific programmatic mandates and requirements. Thus, each program is responsible for documenting how their education investments contribute to their programmatic mission. We do have common measures to ensure that portfolio is coordinated and that we can report our reach across programs. Building capacity to evaluate according to shared and program-specific needs is a major priority for the NOAA education community and we have noted your comment to consider for implementation planning.</p>
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1 National Oceanic and Atmospheric 2 Administration Education Strategic Plan 3 2015-2035: Advancing NOAA’s Mission 4 through Education

5 **Table of Contents**

6	Table of Contents.....	1
7	Introduction.....	2
8	Letter from the Director.....	2
9	NOAA Education Council	4
10	Advancing NOAA’s Mission through Education	5
11	NOAA’s Mandate to Educate.....	5
12	The Foundation for NOAA Education	7
13	NOAA’s Unique Role in Education	8
14	NOAA’s Education Activities	8
15	Guiding Principles	9
16	NOAA’s Education Goals	10
17	Plan Overview	10
18	Goals, Objectives, and Strategies.....	12
19	Goal 1: Science-Informed Society.....	12
20	Goal 2: Conservation and Stewardship.....	15
21	Goal 3: Safety and Preparedness	18
22	Goal 4: Future Workforce.....	21
23	Goal 5: Organizational Excellence.....	24
24	Implementation.....	27
25	Evaluation and Monitoring.....	27
26	Glossary	29
27	References	34

28 **Introduction**

29 **Letter from the Director**

30 Dear Partners and Friends of NOAA Education,

31 We live on a dynamic planet with environments and ecosystems in transition. Communities around
32 the world are becoming more vulnerable to natural disasters and long-term adverse environmental
33 changes. There is growing pressure on our natural resources.

34 As we face these challenges, we strive to become more resilient to them. NOAA provides timely,
35 reliable, and actionable information – based on sound science – to help the Nation make smart
36 decisions that impact the future of society, the economy, and the environment. At NOAA, we call
37 this “environmental intelligence” and producing it is at the core of our mission.

38 Making use of environmental intelligence requires the foresight to build a foundation of
39 understanding when the sky is clear and the ocean is calm. For this reason, NOAA invests in
40 education to expand the public’s understanding and stewardship of Earth systems. These education
41 efforts take place across the country, supporting NOAA’s mission in creative and innovative ways.

42 Congress recognized the importance of NOAA’s education programs with the passage of the
43 America COMPETES Act. The Act gives NOAA broad education authority and directs NOAA to
44 develop an Education Strategic Plan with a 20-year horizon to be updated every 5 years.

45 In this update of our Strategic Plan, we take a fresh look at our programs and priorities to better
46 reflect the broad scope of NOAA Education. We maintain our focus on a science-informed society
47 and workforce development, while highlighting our unique role in safety, preparedness,
48 conservation, and stewardship.

49 The Strategic Plan represents an agency-wide effort with significant input from our external
50 partners. Such partnerships are critical to our success, and we work closely with formal and
51 informal educational institutions, businesses, non-governmental organizations, and concerned
52 individuals who dedicate their time to supporting our mission. Through extensive focus and
53 collaboration, we have crafted a Strategic Plan that guides us and allows us to track our progress.

54 We thank you for your support for NOAA Education. We look forward to working with you to
55 improve our Nation's ability to protect life and property and build sustainable ecosystems and
56 resilient communities.

57 Louisa Koch

58 Director, NOAA Education

59 **NOAA Education Council**

60 The National Oceanic and Atmospheric Administration (NOAA) Education Council members listed
61 below represent education programs across the agency. Through their signatures, each member
62 commits to supporting and enabling the goals and objectives of this Strategic Plan.

Stephanie Bennett

Management and Program Analyst
NOAA Office for Coastal Management

Amy Clark

Gulf of Mexico Program Coordinator
NOAA Bay-Watershed Education and
Training Grant Program

Tanja Fransen

NOAA Warning Coordination
Meteorologists

Julia Galkiewicz

Fellowship Manager
National Sea Grant College Program

Ron Gird

Outreach Program Manager
NOAA National Weather Service

Tracy Hajduk

Education Coordinator
NOAA Office of National Marine
Sanctuaries

Jennifer Hammond

Director
NOAA Teacher At Sea

Atziri Ibanez

National Education Coordinator
National Estuary Research Reserves

Nina Jackson

Education Program Manager
National Environmental Data and
Satellite Information Service

Marlene Kaplan

Deputy Director
NOAA Education

Paula Keener

Director of Education Programs
NOAA Ocean Exploration and Research

Louisa Koch

Director
NOAA Education

Christos Michalopoulos

Deputy Director
NOAA Education

Kate Naughten

Director of Communications
NOAA National Marine Fisheries Service

Frank Niepold

Climate Education Coordinator
NOAA Climate Program Office

Rochelle Plutchak

Communications Specialist
NOAA Oceanic and Atmospheric
Research

Peg Steffen

Education Coordinator
NOAA National Ocean Service

64 **Advancing NOAA's Mission through Education**

65 **NOAA's Vision**

66 Healthy ecosystems, communities, and economies that are resilient in the face of change.

67 **NOAA's Mission: Science, Service, and Stewardship**

68 To understand and predict changes in climate, weather, oceans, and coasts,

69 To share that knowledge and information with others, and

70 To conserve and manage coastal and marine ecosystems and resources.

71 **NOAA's Education Vision**

72 An informed society that uses ocean, coastal, Great Lakes, weather, and climate science to make the
73 best social, economic, and environmental decisions.

74 **NOAA's Education Mission**

75 To educate and inspire the Nation to use science toward improving ocean and coastal stewardship,
76 increasing safety and resilience to environmental hazards, and preparing a future workforce to
77 support NOAA's mission.

78 The National Oceanic and Atmospheric Administration (NOAA) is a science-based agency within the
79 United States Department of Commerce. NOAA is charged with engaging society to support
80 informed decisions through an understanding of Earth system sciences.

81 Education plays a significant role in supporting NOAA's mission. For society to become more
82 resilient, individuals should have the ability to understand scientific processes, consider
83 uncertainty, and reason about the ways that human and natural systems interact. Therefore, it is
84 not enough for NOAA to research Earth systems; NOAA must also empower the Nation to use this
85 information to support healthy ecosystems, communities, and economies.

86 **NOAA's Mandate to Educate**

87 NOAA's role in science education is defined in the America COMPETES Act (P.L. 110-69), which
88 provides broad authority for educational activities. The Act states: "The Administrator of the
89 National Oceanic and Atmospheric Administration shall conduct, develop, support, promote, and
90 coordinate formal and informal educational activities at all levels to enhance public awareness and
91 understanding of ocean, coastal, Great Lakes, and atmospheric science and stewardship by the

92 general public and other coastal stakeholders, including underrepresented groups in ocean and
93 atmospheric science and policy careers. In conducting those activities, the Administrator shall build
94 upon the educational programs and activities of the agency.”

95 The America COMPETES Act directs NOAA to develop a 20-year strategic plan in partnership with
96 ocean and atmospheric scientists, experts in education, and interested members of the public. The
97 NOAA Education community first revised its strategic plan in response to the America COMPETES
98 Act in 2009. In this document, the NOAA Education community shares an updated course of action
99 that now reflects the broad scope of NOAA’s education programs and priorities.

100 The America COMPETES Act complements standing mandates that authorize education in NOAA’s
101 programs, such as the National Marine Sanctuaries System, the National Sea Grant College Program,
102 and the National Estuarine Research Reserve System (see the full list below). These statutes
103 acknowledge the importance of education in fulfilling the distinct laws that NOAA executes, while
104 the America COMPETES Act provides a unifying mandate for educational activities across the
105 agency. The philosophy and priorities of this Strategic Plan are guided by these statutes:

- 106 • America COMPETES Act – 2007, 2011
- 107 • National Sea Grant College Program Act – 1966, 1976, 2002
- 108 • National Marine Sanctuaries Act– 1972, 1980, 1984, 1988, 1992, 1996, 2000
- 109 • National Estuarine Research Reserve System, Coastal Zone Management Act – reauthorized or
110 amended eight times from 1972-1996
- 111 • Magnuson-Stevens Fishery Conservation and Management Act – 1976, 2006
- 112 • Ernest F. Hollings Scholarship Program, Consolidated Appropriations Act – 2005
- 113 • Coral Reef Conservation Act – 2000
- 114 • Tsunami Warning and Education Act – 2006
- 115 • Federal Ocean Acidification Research and Monitoring Act – 2009
- 116 • Ocean Exploration and Research, Omnibus Public Land Management Act – 2009

117 This Strategic Plan is also shaped by the following documents, which discuss the need for science
118 education reform and the advancement of lifelong learning opportunities in ocean, coastal, Great
119 Lakes, weather, and climate sciences:

- 120 • U.S. Global Change Research Program: National Climate Assessment Report ([2014](#))
- 121 • The Intergovernmental Panel on Climate Change: 5th Assessment Report ([2013](#))
- 122 • The Ocean Research Advisory Panel: Leveraging Ocean Education Opportunities ([2013](#))

- 123 • Committee on STEM Education, National Science and Technology Council: Federal Education
124 5-Year Strategic Plan ([2013](#))
- 125 • The National Global Change Research Plan 2012-2021: A Strategic Plan for the U.S. Global
126 Change Research Program ([2012](#))
- 127 • National Research Council of the National Academies: A Framework for K-12 Science
128 Education – Practices, Crosscutting Concepts, and Core Ideas ([2011](#))
- 129 • National Research Council of the National Academies: NOAA’s Education Program, Review
130 and Critique ([2010](#))
- 131 • National Academies Report: Rising Above the Gathering Storm, Revisited ([2010](#))
- 132 • NOAA’s Next Generation Strategic Plan ([2010](#))
- 133 • National Academies Report: Rising Above the Gathering Storm ([2005](#))
- 134 • The U.S. Commission on Ocean Policy, An Ocean Blueprint for the 21st Century ([2004](#))
- 135 • Discovering Earth’s Final Frontier: A U.S. Strategy for Ocean Exploration ([2000](#))

136 **The Foundation for NOAA Education**

137 NOAA’s scientific work is the foundation for the agency’s educational content. NOAA-related
138 sciences include the entire collection of disciplines that NOAA employs. Studying Earth’s physical
139 and biological systems requires expertise in science, technology, engineering, and mathematics
140 (STEM). NOAA’s work also relies heavily on input from social science, management, policy, and
141 other disciplines. These fields are essential to communicating effectively, managing shared
142 resources, and making decisions that involve the environment.

143 NOAA’s work is inherently interdisciplinary. Earth systems are complex and no single scientific
144 discipline can capture the causes and effects of changes within them. Understanding the causes and
145 implications of changes in coral reef health, for example, involves global climate, hydrology, land
146 use planning, oceanography, fisheries management, and marine resource economics. Likewise,
147 projecting the future climate is a product of computer science, statistics, sociology, meteorology,
148 climatology, and other sciences.

149 NOAA strives to incorporate authentic research practices into education and inspire the next
150 generation of experts in the entire suite of disciplines that support the agency’s mission.

151 **NOAA's Unique Role in Education**

152 NOAA's contributions to science education are unique among federal agencies. As the National
153 Research Council observed, NOAA is well positioned to contribute to both environmental literacy
154 and STEM education (National Research Council, 2010). However, NOAA's role in education is
155 broader than these two areas. The agency's niche is defined by its mission and NOAA brings the
156 following resources to this unique space:

- 157 • **NOAA's topics:** NOAA is an international leader in science, service, and stewardship. Topics
158 within NOAA's purview span from the surface of the sun to the depths of the ocean floor.
159 NOAA's service and stewardship functions connect research to applications that benefit the
160 Nation, drawing on advancements in technology and our understanding of society. The
161 agency's mission unites our intellectual drive to understand and explore with our civic duty to
162 protect communities and the environment. NOAA Education can reach and inspire audiences
163 through many points along the spectrum of science, service, and stewardship.
- 164 • **NOAA's assets:** NOAA tackles real-world issues using labs, ships, buoys, and satellites
165 equipped with a myriad of specialized instruments that gather environmental data. From this
166 wealth of information, NOAA produces valuable data products, including weather statements,
167 tide tables, nautical charts, and disaster warnings. NOAA manages special places, such as
168 National Marine Sanctuaries and National Estuarine Research Reserves, both of which
169 connect the public with natural and cultural resources. NOAA's resources also include its
170 people – experts in science, engineering, policy, management, communications, and other
171 disciplines. These diverse assets provide excellent platforms for engaging the public in
172 education.
- 173 • **NOAA's geographic reach:** NOAA maintains a presence in every U.S. state, as well as Guam,
174 Puerto Rico, and the Pacific Islands. This broad reach allows the agency to connect with
175 constituents in different regions, understand their needs from a local perspective, and deliver
176 regionally relevant products and services. NOAA's numerous locations across the U.S. create
177 many opportunities for the public to interact directly with NOAA experts and resources.

178 **NOAA's Education Activities**

179 NOAA conducts a wide variety of education activities. Each program has distinct goals but all strive
180 to put scientific information in the hands of the public. Below are some examples of the types of
181 educational work that NOAA undertakes:

- 182 • Supporting formal education by educating students, creating classroom materials, providing
183 professional development opportunities for educators, and supporting educator networks.
- 184 • Funding scholarships and internships for students, primarily in higher education.
- 185 • Partnering with universities, including Minority Serving Institutions.
- 186 • Infusing NOAA science content, expertise, and data visualization technologies into zoos,
187 aquariums, museums, science centers, and other informal education institutions.
- 188 • Funding partnerships that support NOAA’s mission through competitive grants.
- 189 • Creating opportunities for individuals to become involved in NOAA research through citizen
190 science, place-based education, hands-on learning, and training.
- 191 • Supporting the development of literacy frameworks that outline the fundamental concepts
192 of Earth system science.
- 193 • Providing online access to NOAA’s educational resources.
- 194 • Working with international partners to improve understanding of the Earth system around
195 the world.
- 196 • Performing outreach designed to build awareness, develop relationships, promote
197 education products, and inspire the public to pursue more learning opportunities.

198 NOAA cannot hope to engage the entire Nation in education and outreach on its own. Partnerships
199 expand NOAA’s reach by leveraging expertise and sharing resources (Payne and Baek, 2014).
200 NOAA’s partners include museums and aquariums; non-governmental organizations; educational
201 businesses; professional societies; education associations; stakeholder groups and resource users;
202 fishery management councils and commissions; state, local, and tribal governments; state and local
203 school systems; academia; and individuals. NOAA works with partners to advance understanding of
204 the Earth system by participating in planning initiatives, funding agreements and joint research,
205 sharing educational content, and collaborating on projects of common interest.

206 **Guiding Principles**

207 NOAA is committed to developing and supporting education programs and products with high
208 quality standards. NOAA strives to provide education resources and activities that are:

- 209 • Aligned with the agency’s strategic goals and performance objectives;
- 210 • Aligned with appropriate national and state education standards;
- 211 • Based on the best available science;
- 212 • Informed by evidence-based practices;

- 213 • Designed to incorporate authentic scientific practices;
- 214 • Supportive of literacy principles that are relevant to the agency’s scientific mission;
- 215 • Responsive to the needs of the participants through engagement and open communication;
- 216 • Designed to be consistent in quality and sustainable; and
- 217 • Continually evaluated and improved.

218 **NOAA’s Education Goals**

219 Based on NOAA’s mission, strengths, and the future needs of our society, the agency has established
220 five education goals:

221 **Goal 1: Science-Informed Society**

222 An informed society has access to, interest in, and understanding of NOAA-related sciences and
223 their implications for current and future events.

224 **Goal 2: Conservation and Stewardship**

225 Individuals and communities are actively involved in stewardship behaviors and decisions that
226 conserve, restore, and protect natural and cultural resources related to NOAA’s mission.

227 **Goal 3: Safety and Preparedness**

228 Individuals and communities are informed and actively involved in decisions and actions that
229 improve preparedness, response, and resilience to challenges and impacts of hazardous weather,
230 changes in climate, and other environmental threats monitored by NOAA.

231 **Goal 4: Future Workforce**

232 A diverse and highly-skilled future workforce pursues careers in disciplines that support NOAA’s
233 mission.

234 **Goal 5: Organizational Excellence**

235 NOAA functions in a unified manner to support, plan, and deliver effective educational programs
236 and partnerships that advance NOAA’s mission.

237 **Plan Overview**

238 The NOAA Education community developed this plan through collaborative discussion, with input
239 from NOAA educators, staff, leadership, and other interested parties. The community designed the
240 plan to build on the strengths of NOAA Education, but also carefully considered areas for growth,
241 including feedback from *NOAA’s Education Program: Review and Critique* ([National Research](#)

242 [Council, 2010](#)). Above all, the plan provides guidance for NOAA Education and a framework for
243 tracking and reporting progress.

244 The goals are interrelated and each has a different scope and focus. Goal 1 aims to help the Nation
245 understand the science that informs NOAA's work. Goal 1's audience is all members of society, as
246 NOAA Education strives to help everyone take advantage of NOAA's resources. Goal 2 builds on
247 Goal 1 to give individuals and communities the knowledge, skills, and tools they need to conserve
248 and steward ocean and coastal ecosystems. Goal 3 builds on Goal 1 to help individuals and
249 communities access the information they need to stay safe from natural hazards. The audience in
250 Goal 2 and Goal 3 is intentionally different from that of Goal 1. Individuals and communities across
251 the Nation have different needs and opportunities when it comes to conservation and stewardship
252 or safety and preparedness, and may choose to build on Goal 1 in different ways. Goal 4 also builds
253 on Goal 1 to support students and emerging professionals who choose to pursue NOAA-related
254 career pathways and join the NOAA mission workforce. Goal 5 supports all goals by improving
255 internal capacity to ensure that NOAA Education operates efficiently and effectively.

256 In the pages that follow, the NOAA Education community outlines its approach for achieving these
257 goals. Each goal is accompanied by objectives, strategies, and evidence of progress statements.

- 258 • **Goals** state the desired, long-term outcomes for society.
- 259 • **Objectives** describe the desired state of NOAA's target audiences within each of the goals.
- 260 • **Strategies** indicate what NOAA will do to achieve the objectives. Given the complexity of
261 this Strategic Plan, the NOAA Education community chose to develop strategies that
262 highlight high-priority, representative activities under each goal. As a result, one or more
263 strategies may be employed to achieve the objectives.
- 264 • **Evidence of progress** statements describe the measurable results the community is
265 working to achieve over the next five years. The evidence of progress statements
266 correspond to the numerical objectives; for instance, Evidence of Progress 1.1a indicates
267 what progress will look like for Objective 1.1.

268 **Goals, Objectives, and Strategies**

269 **Goal 1: Science-Informed Society**

270 *An informed society has access to, interest in, and understanding of NOAA-related sciences and their*
271 *implications for current and future events.*

272 Resilient communities depend upon a scientifically-informed and engaged public. Leaders in Earth
273 system science education echo the need for an informed society, stating that public understanding
274 of Earth's interconnected systems is crucial to our ability to apply knowledge and problem-solving
275 skills to real-world issues ([Hoffman and Barstow, 2007](#)).

276 The ocean, coastal, Great Lakes, weather, and climate systems that NOAA studies affect people of all
277 backgrounds, regardless of age, socioeconomic status, or education level. As such, NOAA works with
278 partners in education to reach a diverse range of audiences. NOAA contributes scientific expertise,
279 laboratories, field sites, monitoring systems, environmental satellites, weather radar, world class
280 data centers, and more to these partnerships. NOAA's assets can be incorporated into education
281 programs that engage youth and adults from all backgrounds in locally and globally relevant,
282 inquiry-based learning opportunities that are applicable to their daily lives.

283 NOAA is committed to building capacity for developing science-informed citizens through our
284 Nation's formal education system. NOAA collaborates with local, state, and national education
285 decision makers and curriculum developers to establish education materials and professional
286 development programs that support education in NOAA-related topic areas. The formal education
287 system also provides an excellent opportunity to engage young people in NOAA-related science,
288 service, and stewardship and inspire the next generation of environmental leaders. This
289 commitment extends to higher education through extensive partnerships with colleges and
290 universities.

291 Informal education is uniquely positioned to connect the public with current research and plays a
292 critical role in delivering unbiased, robust, and timely information to aid decision-making ([Field
293 and Powell, 2001](#)). Indeed, most Americans learn the majority of their scientific information outside
294 of the classroom in free-choice learning environments ([Falk and Dierking, 2010](#)). Research shows
295 that the public trusts the information they receive from informal science centers, making these
296 institutions ideal conduits for NOAA's science-based information ([The Ocean Project, 2014](#)). NOAA
297 collaborates with informal education institutions and organizations to showcase and interpret

298 NOAA-related science, data, and discoveries. NOAA also provides and supports citizen science
299 opportunities that involve individuals in collecting data for research and resource management.

300 NOAA supports a variety of activities that allow NOAA staff to share their expertise, communicate
301 one-on-one with the public, and stimulate further interest in NOAA-related issues. NOAA supports
302 environmental literacy by contributing to resources, such as the ocean and climate literacy
303 frameworks. NOAA experts serve as judges at science and career fairs, meet with groups of students
304 and professionals, visit classrooms, lead engineering challenges, and more. The agency participates
305 in outreach at industry events, professional education network meetings, and other venues. All of
306 these activities facilitate open communication with the public to create opportunities for education,
307 engagement, and input from society.

308 NOAA Education Goal 1 aims to increase the public's ability to access, understand, and use the
309 science and services that NOAA provides. The agency's actions – such as issuing severe weather
310 warnings, providing reliable climate science and data, maintaining safe and productive fisheries,
311 protecting endangered marine species, and collecting environmental data – protect people's lives
312 and livelihoods. Likewise, the resources NOAA manages are impacted by the choices that
313 individuals and communities make. Goal 1 lays the groundwork to support society in making sound
314 environmental decisions and being responsible stewards of the natural resources that NOAA
315 manages.

316 **Objectives**

317 1.1. Youth and adults from all backgrounds improve their understanding of NOAA-related
318 sciences by participating in education and outreach opportunities.

319 1.2. Formal and informal educators integrate NOAA-related sciences into their curricula,
320 practices, and programs.

321 1.3. Formal and informal education organizations integrate NOAA-related science content
322 and collaborate with NOAA scientists on the development of exhibits, media,
323 materials, and programs that support NOAA's mission.

324 **Strategies**

325 1.A. Collaborate with education decision-makers and curricula developers to establish
326 regionally relevant education materials and professional development programs that
327 support the implementation of education standards.

328 1.B. Partner with informal education institutions and organizations to showcase and
329 interpret NOAA-related science, data, and discoveries.

330 1.C. Develop and support local, regional, and national educator networks to promote and
331 facilitate the teaching of NOAA-related content.

332 1.D. Promote and coordinate citizen science opportunities.

333 1.E. Develop and support collaborative learning opportunities for educators, students, and
334 the public to interact directly with experts via face-to-face and distance learning
335 venues.

336 1.F. Develop and support the creation and distribution of tools, exhibits, and learning
337 materials.

338 **Evidence of Progress**

339 As evidence of advancing this goal and supporting objectives in the next five years, NOAA will have:

340 1.1a. Increased education and outreach opportunities for youth and adults from all
341 backgrounds.

342 1.2a. Increased integration of NOAA resources and topics by educators into their curricula,
343 practices, and programs.

344 1.3a. Expanded partnerships that lead to deeper integration of NOAA resources into the
345 development of exhibits, media, materials, and programs.

346 **Goal 2: Conservation and Stewardship**

347 *Individuals and communities are actively involved in stewardship behaviors and decisions that*
348 *conserve, restore, and protect natural and cultural resources related to NOAA's mission.*

349 NOAA is responsible for fulfilling conservation laws that protect ecosystems, conserve marine
350 species, and promote sustainable use of living marine resources. Human actions have had a
351 profound impact on natural systems and these laws have been enacted to conserve resources for
352 generations to come. At NOAA, stewardship education aims to improve public understanding of
353 NOAA's role in management and the science behind it. Stewardship education provides
354 opportunities for participants to connect with local ecosystems and tools that can help them
355 understand how individual behavior impacts the environment. These activities give people an
356 active voice in managing and protecting resources that affect them on both a local and global scale.

357 NOAA embraces educational methods and practices that promote environmental problem-solving
358 and stewardship behaviors and build appreciation of the connections between people and the
359 environment. NOAA promotes hands-on scientific inquiry, which results in increased knowledge of
360 important environmental concepts and stronger environmental stewardship behavior (Zint et al.,
361 2014; [Penuel et al., 2005](#)). Providing environmental education opportunities for children has been
362 shown to have a positive influence on adult conservation behavior ([Damerell et al., 2013](#)).
363 Expanding awareness, building confidence, and providing support for these experiential teaching
364 methods are part of NOAA's strategy in addressing the need for a science-informed society that
365 bases conservation and stewardship decisions on sound science.

366 NOAA's stewardship and conservation programs are often located in the coastal areas that NOAA
367 manages. Place-based education immerses the learner in local heritage, culture, landscapes, and
368 experiences. These opportunities form a foundation for studying STEM, language arts, social
369 studies, history, and other subjects. This interdisciplinary approach encourages participants to use
370 the schoolyard, community, public lands, and other special places as resources, turning
371 communities into classrooms. The National Marine Sanctuary System, National Estuarine Research
372 Reserve System, and living coastlines that NOAA manages provide real-world contexts for
373 educational opportunities. These concepts are also applicable to inland communities and those who
374 live in upstream watersheds. NOAA's grants, distance learning opportunities, and educational
375 partnerships extend the agency's ability to positively impact communities around the Nation.

376 Education programs and products can provide unique cultural contexts. Stewardship education is
377 an important component of co-managing natural resources with Native groups. Native science, or
378 ways of knowing, and NOAA-related science can come together to develop a mutually inclusive
379 learning experience ([Maryboy et al., 2012](#)) where science builds on Native ways of knowing, and
380 indigenous knowledge provides a way to better understand the complexity and interrelationships
381 of the systems that NOAA studies.

382 Decision-making related to sustainable fisheries management, endangered species conservation,
383 and other NOAA-related topics has been a source of controversy between resource managers, the
384 public, and industry. Stewardship education is intended to help navigate conflicts by engaging the
385 public early and often in decisions and actions that affect the resources they use and care about.
386 Indeed, several of NOAA's legislative mandates have built public engagement into the process of
387 resource management, ensuring that the public has a voice in marine affairs. Understanding the
388 principles of sustainable management can also help the public support local industries and take
389 appropriate action when concerned about environmental issues, such as overfishing, habitat
390 degradation, invasive species, watershed degradation, and waterfront development and access.
391 Conservation and stewardship education promotes environmental solutions, civic engagement, and
392 sound choices, fostering an educated public with an improved capacity to make scientifically-
393 informed decisions.

394 **Objectives**

- 395 2.1. Youth and adults from all backgrounds are knowledgeable about conservation and
396 stewardship practices and skilled in applying them to address local, regional, national, and
397 global issues related to NOAA's mission.
- 398 2.2. Formal and informal educators integrate NOAA-related conservation and stewardship
399 concepts and activities into their curricula, practices, and programs.
- 400 2.3. Formal and informal education organizations establish guidance and provide support
401 towards increasing participation of education audiences in conservation and stewardship
402 activities related to NOAA's mission.

403 **Strategies**

- 404 2.A. Participate in and coordinate with local, state, and national environmental education
405 initiatives that support NOAA's mission.

406 2.B. Develop and support opportunities for youth and adults to understand conservation
407 policies and engage in stewardship actions.

408 2.C. Partner on education initiatives with organizations that share NOAA's conservation and
409 stewardship goals.

410 2.D. Deliver and support hands-on science education programs that explore the influences of
411 human activity on ocean and coastal ecosystems.

412 **Evidence of Progress**

413 As evidence of advancing this goal and supporting objectives in the next five years, NOAA will have:

414 2.1a. Increased participation of youth and adults from all backgrounds in education
415 programs that promote conservation and stewardship.

416 2.2a. Increased integration of NOAA-related conservation and stewardship information by
417 educators into their curricula, practices, and programs.

418 2.3a. Expanded partnerships that lead to increased participation of youth and adults in
419 conservation and stewardship activities.

420 **Goal 3: Safety and Preparedness**

421 *Individuals and communities are informed and actively involved in decisions and actions that improve*
422 *preparedness, response, and resilience to challenges and impacts of hazardous weather, changes in*
423 *climate, and other environmental threats monitored by NOAA.*

424 NOAA is responsible for the science behind understanding, forecasting, and responding to threats
425 that involve weather, water, climate, and the marine and coastal environment. NOAA issues
426 forecasts, watches, and warnings based on observations of the natural world from weather radar,
427 ground observations, ships, satellites, and sophisticated models of environmental systems. Since
428 individuals and communities take action based on this guidance, it is important that NOAA's
429 constituents understand when and how to respond to hazards. Education is a key component of a
430 safe and prepared nation, and directly supports NOAA's Weather-Ready Nation initiative.

431 Safety and preparedness decisions not only protect lives and property, but also maintain safe access
432 to recreational opportunities and support vibrant economies on land and sea. Awareness can help
433 communities make the best choices to plan for long-term resiliency. Yet despite NOAA's best efforts
434 to produce the most accurate science and products, NOAA's warnings and alerts do not always lead
435 to effective responses. NOAA is increasingly aware that human responses to a threat are as diverse
436 as people themselves. Social science, risk communication, and education all contribute to a safe and
437 prepared nation. NOAA recognizes that, while the agency will continue to improve our ability to
438 understand and predict hazards, it is also imperative for NOAA to understand the society it serves.

439 NOAA strives to make science content accessible, understandable, and engaging to all members of
440 society. To reach audiences from all backgrounds, safety and preparedness education is conducted
441 in formal and informal educational settings and outreach events. Federal and non-federal partners
442 – such as Weather-Ready Nation Ambassadors, industry partners, state and tribal organization, and
443 disaster response and relief organizations – are important to extending NOAA's reach in these
444 critical areas.

445 Safety and preparedness education is an example of integrated STEM education, which emphasizes
446 connections between disciplines and relevance to daily life ([National Academy of Engineering
447 Research Council, 2011](#)). When anticipating, preparing for, and responding to a single event, such
448 as an oil spill, tsunami, or hurricane, NOAA draws from a wide array of expertise, including
449 meteorology, hydrology, fisheries, nautical charting, oceanography, communication, and social
450 science. These topics are also highly relevant to individuals and communities. Infusing NOAA's

451 science content into the classroom exposes children to integrated STEM topics that not only matter
452 in their daily lives, but might even help save lives. Students often relay this information to their
453 families (Duvall and Zint, 2007), which is particularly useful for gaining access to underserved
454 communities, especially those in which English is not the primary language.

455 People use NOAA's educational resources on environmental threats because they trust the
456 information NOAA provides. NOAA's managers and scientists must be creative and flexible in
457 understanding where people get information they trust, and ensuring that NOAA's information is
458 accessible through these sources. Education helps ensure that messages reach a broader audience.
459 Safety and preparedness education infuses practical knowledge of potential environmental threats,
460 and how to respond to them into science exhibits, media, materials, and programs. To this end,
461 NOAA also partners with emergency management organizations and the private sector to reach
462 diverse audiences and achieve a consistent and integrated approach to responding to and preparing
463 for environmental hazards.

464 **Objectives**

465 3.1. Youth and adults from all backgrounds are aware of, prepare for, and appropriately
466 respond to environmental hazards that impact health, safety, and the economy in their
467 communities.

468 3.2. Formal and informal educators use and produce education materials and programs that
469 integrate and promote consistent science-based messaging on hazards, impacts, and
470 societal challenges related to water, weather, and climate.

471 3.3. Formal and informal education institutions integrate water, weather, and climate hazard
472 awareness, preparedness, and response information into curricula, exhibits, and programs
473 that create learning opportunities for youth and adults.

474 **Strategies**

475 3.A. Collaborate and coordinate with partners on national risk awareness and response
476 education campaigns to integrate science content and expertise.

477 3.B. Build and partner on education products and programs focused on improving economic
478 and health conditions in response to weather, water, climate, and other environmental
479 threats.

480 3.C. Engage youth and adults directly and through partners in multi-generational learning
481 activities to improve community awareness and involvement in preparedness and
482 response efforts.

483 **Evidence of Progress**

484 As evidence of advancing this goal and supporting objectives in the next five years, NOAA will have:

485 3.1a. Increased awareness of environmental hazards, their impacts, and preparedness actions
486 by youth and adults from all backgrounds.

487 3.2a. Increased integration of safety and preparedness information by educators in their formal
488 and informal education and professional development programs.

489 3.3a. Expanded partnerships that lead to increased integration of safety and preparedness
490 information into curricula, exhibits, and programs.

491 **Goal 4: Future Workforce**

492 *A diverse and highly-skilled future workforce pursues careers in disciplines that support NOAA's*
493 *mission.*

494 NOAA relies on a world-class workforce with the scientific and technical skills needed to address
495 the environmental challenges confronting our Nation and the planet. *Rising Above the Gathering*
496 *Storm, Revisited* ([National Academy of Sciences, 2010](#)), states that building a workforce literate in
497 STEM is crucial to maintaining America's competitiveness in a rapidly-changing global economy. As
498 the global population increases, there is greater demand on the Earth's natural systems; this creates
499 a greater need for education and research to understand the complexities of human impacts and
500 develop strategies for sustainable solutions.

501 Workforce considerations begin by inspiring students to consider careers in disciplines that
502 support NOAA's mission early in their education. A 2011 study found that 78% of STEM college
503 students had decided to major in STEM fields by the time they were in high school; 21% had
504 discovered their interest in STEM in middle school or earlier ([Harris Interactive](#)). Youth who
505 expected to have a career in science (i.e., who identified an interest in science in middle school or
506 earlier) were more likely to graduate from college with a science degree, thus emphasizing the
507 importance of early engagement ([Tai et al., 2006](#)). For these reasons, NOAA provides opportunities
508 for career exploration at all grade levels.

509 It is important to maintain continuity in workforce development so that youth who are excited
510 about disciplines that support NOAA's mission have opportunities to build research skills and
511 experience real-world applications over time. NOAA provides unique access to ships, laboratories,
512 data, and other resources that can be incorporated into students' experiences, augmenting their
513 education and providing hands-on work experience. To this end, NOAA partners with academic
514 communities, providing grants, internships, fellowships, and other experiential activities to
515 students, educators, researchers, policy makers, managers, and institutions.

516 Workforce shortages are anticipated in disciplines that support NOAA's mission, including
517 quantitative ecology and economics ([U.S. Dept. of Commerce and U.S. Dept. of Education, 2008](#)). The
518 number of jobs in atmospheric sciences is anticipated to grow by 10 percent from 2012 - 2022,
519 keeping pace with the national average job growth rate. Positions for environmental scientists and
520 geoscientists are expected to grow by 15 - 16 percent. Workforce considerations extend beyond
521 NOAA's immediate needs to the entire network of researchers, analysts, educators, and others who

522 collaborate with NOAA. NOAA partners extensively with academic educators and researchers,
523 informal education institutions, and nonprofit organizations to reach a broad array of students and
524 emerging professionals.

525 To maintain a pipeline of innovative talent, NOAA strives to cultivate a workforce that reflects the
526 diversity of the Nation. According to the U.S. Census Bureau, minorities constituted 37 percent of
527 the U.S. population in 2013, and this proportion is growing rapidly. In 2013, underrepresented
528 minorities (based on race and ethnicity) constituted 17 percent of NOAA's federal workforce and
529 9.5 percent of those in leadership positions (at or above GS-13). NOAA Cooperative Science Centers,
530 Minority Serving Institutions, and national technical, professional, and industrial organizations that
531 serve underrepresented groups are all essential to inspiring students to consider career paths
532 related to NOAA. These partnerships provide concrete examples of success and a template for other
533 institutions and agencies to follow (Robinson et al. 2007). NOAA's established best practices include
534 promoting partnerships among students and professionals, allowing students to conduct research
535 prior to graduate school, and providing mentorship opportunities (Huntoon and Lane, 2007).

536 Diversity brings a wider variety of perspectives and approaches to leadership, policy, strategic
537 planning, problem solving, and decision making ([Forbes, 2011](#)). As communities become more
538 vulnerable to natural disasters and pressures on our natural resources intensify, we need the best
539 and brightest from all backgrounds to develop solutions to complex environmental challenges.
540 Additionally, recruiting students from diverse backgrounds – including communities that
541 historically have not had access to NOAA's resources – can improve NOAA's ability to reach and
542 engage all members of society. As the demographics of the country shift, adapting NOAA's products
543 and services for use by diverse communities will be increasingly important. NOAA is committed to
544 strengthening the pool of candidates from underrepresented groups who are trained and graduate
545 with degrees in disciplines that support NOAA mission.

546 **Objectives**

- 547 4.1. Students, particularly from underrepresented groups, consider education and career
548 pathways in disciplines that support NOAA's mission.
- 549 4.2. NOAA and partner institutions leverage federally-funded assets to provide students,
550 particularly those from underrepresented groups, with experiential learning, research,
551 and scholarship opportunities.

552 4.3. Postsecondary students, particularly from underrepresented groups, pursue and complete
553 degrees in disciplines critical to NOAA's mission.

554 4.4. Graduates completing NOAA-supported student opportunities continue education, enter
555 the workforce, and advance in careers that support NOAA's mission.

556 **Strategies**

557 4.A. Support local, regional, and national career exploration programs and education resources
558 that target youth and young adults, particularly those from underrepresented
559 communities.

560 4.B. Provide scholarships, fellowships, internships, and student training opportunities that
561 promote experiential learning.

562 4.C. Establish and maintain partnerships with Minority Serving Institutions, professional
563 associations, and other organizations to improve graduation rates of underrepresented
564 students.

565 4.D. Collaborate with academic partners to align student preparation with NOAA's scientific
566 and workforce needs.

567 4.E. Strengthen the links between education initiatives and career pathways at NOAA and
568 related organizations with emphasis on high-need career fields and underrepresented
569 groups.

570 **Evidence of Progress**

571 As evidence of advancing this goal and supporting objectives in the next five years, NOAA will have:

572 4.1a. Increased integration of college and career information into education programs.

573 4.2a. Increased the number of students, particularly from underrepresented groups, who
574 participate in experiential learning, research, and scholarship opportunities.

575 4.3a. Increased the proportion of trained students from underrepresented groups pursuing
576 careers in disciplines critical to NOAA's mission.

577 4.4a. Improved understanding of the trajectories of NOAA-supported students along their
578 education and career pathways.

579 **Goal 5: Organizational Excellence**

580 *NOAA functions in a unified manner to support, plan, and deliver effective educational programs and*
581 *partnerships that advance NOAA's mission.*

582 NOAA strives to use taxpayer dollars efficiently and effectively. Given the magnitude of the
583 challenges facing the Nation and the increasing role that NOAA science plays in maintaining
584 resilient ecosystems, communities, and economies, NOAA's education efforts must be coordinated,
585 monitored, and continually improved.

586 NOAA's people are the driving force behind organizational excellence. NOAA Education is made
587 possible by the work of passionate educators, scientists, and other individuals – all of whom work
588 in their respective roles to keep NOAA Education moving forward. The America COMPETES Act
589 provides a mandate to all of NOAA to participate in education. NOAA leadership has embraced this
590 call, establishing a policy that encourages employee participation in NOAA programs, projects,
591 events, and activities that seek employee volunteers to engage, educate, or inspire audiences ([NOAA](#)
592 [Administrative Order, 2013](#)).

593 The NOAA Education Council is the coordination body that promotes organizational excellence
594 among NOAA's education programs. The scope of the Education Council has become more
595 representative and inclusive of NOAA's education activities, evolving from an early focus on
596 education policy to its current focus on connecting with, learning from, and supporting the NOAA
597 Education community. The Education Council helps facilitate cross-agency work, increases capacity
598 for NOAA educators, and provides a forum for discussion and improvement with the aim of helping
599 NOAA's education programs to achieve more collectively than they could alone. The Education
600 Council also supports efforts to highlight the value of NOAA Education to audiences both internal
601 and external to NOAA.

602 NOAA Education programs are more relevant and effective when they are responsive to constituent
603 needs. For example, identifying topics to include in professional development programs for external
604 educators or ensuring that NOAA products are compatible with current environmental education
605 initiatives and national science education standards allows NOAA to better serve its audiences.
606 NOAA must understand and respond to the needs of its educational partners and constituents when
607 developing educational products and services. Collaboration and partnerships within and outside of
608 NOAA are essential to maximizing the agency's effectiveness and broadening its reach in education
609 projects.

610 In a time of increased scrutiny of federal investments, NOAA must be able to report progress
611 toward goals and objectives and demonstrate the value of its activities. Therefore, evaluating this
612 Strategic Plan is one of the NOAA Education community's top priorities. The evidence of progress
613 statements, for instance, will allow NOAA Education programs across the agency and the Nation to
614 report shared accomplishments toward the objectives.

615 Underserved communities are often most vulnerable to the environmental hazards within NOAA's
616 purview, indicating a growing need to develop culturally-relevant materials. To meet these needs,
617 the NOAA Education community aims to produce a coordinated portfolio of educational products,
618 programs, and services targeting underserved audiences. This aspect of Goal 5 complements Goal 4,
619 which focuses specifically on workforce development, by increasing communication and
620 coordination within and beyond NOAA to maximize the reach and impact of NOAA's education
621 programs.

622 **Objectives**

623 5.1. Leaders internal and external to NOAA recognize and support education investments as a
624 way to achieve agency mandates, mission, and goals.

625 5.2. The NOAA Education community develops implementation plans and establishes agency
626 education priorities informed by stakeholder needs and national initiatives.

627 5.3. NOAA educators and partners collaborate at local, regional, and national levels to
628 coordinate efforts, build capacity, and better serve educational audiences.

629 5.4. NOAA and partner organizations use effective evaluation, performance monitoring, and
630 evidence-based approaches in the design and management of educational programs,
631 products, and services.

632 5.5. NOAA develops and supports a coordinated portfolio of products, programs, and
633 partnerships that improves education opportunities in NOAA-related content areas for
634 underserved audiences.

635 **Strategies**

636 5.A. Collect and present to key decision-makers the best available evidence to demonstrate the
637 connection between NOAA's education investments and the agency's mission.

638 5.B. Collaborate with federal and non-federal partners to leverage expertise and funding.

639 5.C. Establish and support NOAA educator networks with emphasis on cross-agency
640 communication, coordination, and professional development.

641 5.D. Develop consistent and coordinated educational approaches across NOAA for high-
642 priority educational topics.

643 5.E. Create and adopt common performance measures and evaluation practices in NOAA-
644 funded education programs.

645 **Evidence of Progress**

646 As evidence of advancing this goal and supporting objectives in the next five years, NOAA will have:

647 5.1a. Increased recognition by leaders of the importance of education in achieving NOAA's
648 mission.

649 5.2a. Implemented systematic approaches for collecting data about constituent needs to inform
650 NOAA's education priorities.

651 5.3a. Expanded opportunities for communication and learning within the NOAA Education
652 community.

653 5.4a. Improved the practice of evaluation by educators to inform the improvement and
654 management of NOAA Education programs.

655 5.5a. Developed a coordinated portfolio of products, programs, and partnerships that target
656 underserved audiences.

657 **Implementation**

658 The America COMPETES Act not only requires NOAA to develop education goals, but also calls for
659 the development of actions to carry out this Strategic Plan.

660 The NOAA Education community actively participated in developing this document. As a result, it is
661 aligned with the agency's various education mandates and priorities and NOAA Education
662 programs have an improved line-of-sight between their work and this Strategic Plan. The goals,
663 objectives, and strategies provide a framework to focus and coordinate NOAA Education. This
664 guidance builds on the existing capabilities of NOAA Education programs and partnerships to
665 accomplish this work. The NOAA Education community will develop shorter-term implementation
666 plans that consider immediate needs, opportunities, and resources.

667 **Evaluation and Monitoring**

668 This Strategic Plan provides the foundation for the NOAA Education performance measurement
669 system. NOAA is committed to strengthening the monitoring and evaluation capabilities of its
670 education programs and using data to improve program delivery. The NOAA Education Council
671 oversees NOAA-wide efforts to improve the measurement and evaluation of education programs.

672 The evaluation plan for this Strategic Plan will monitor NOAA's progress toward the long-term
673 goals, objectives, and evidence of progress statements. The plan includes a review process that
674 leverages existing data collection and reporting processes and draws on the best available evidence
675 on an annual basis. To assess progress, the NOAA Education community will review data from its
676 own programs, projects, and products as well as contributions from partners. Each annual review
677 of the Strategic Plan will include the results, findings, and conclusions of individual evaluations
678 from within the portfolio. These results will be used to make adjustments in implementation. This
679 evaluation strategy meets accountability requirements and takes a comprehensive view across the
680 entire NOAA Education portfolio to assess progress across the NOAA Education community.

681 The NOAA Education community will collect and use the following evidence to inform
682 implementation and effectiveness:

- 683 • **Common measures:** A shared and consistent set of definitions developed with input from
684 the NOAA Education Council that enables NOAA Education programs to report consistent
685 outputs and outcomes. Members of the Education Council implement, collect, and report

686 findings. The NOAA Education community will continue to develop new measures to
687 address gaps in evidence of outcomes and impacts.

- 688 • **Program evaluations:** Individual programs, units, and offices are responsible for
689 evaluating and improving their own programs. Evidence from these studies will be
690 included in the annual review as results become available.
- 691 • **Annual accomplishments:** Qualitative evidence told in a narrative format that includes the
692 points of relevance, response, and results. Accomplishments tell the impact of a program in
693 context, providing a richer picture than can be shown with quantitative data alone, and are
694 presented in the NOAA Education Annual Accomplishment Reports.
- 695 • **Working group milestones:** Working groups are the main avenue for organizing
696 collaborative efforts at the Education Council. Evidence of progress cannot rely only on
697 outcomes, but also needs to monitor the activities undertaken to reach those outcomes.
698 Milestones are major tasks that have been completed, or performance thresholds that have
699 been exceeded.
- 700 • **Web analytics:** Websites are an important part of reaching the Nation and disseminating
701 information and products. Web analytics are powerful tools for tracking the success of
702 efforts that use the Web as part of their program.
- 703 • **National statistics:** Data from government agencies, research studies, and nonprofit
704 organizations can be used to provide a picture of relevant characteristics of target
705 populations. Statistics also provide context to the scope of issues being addressed by
706 programs as they work to achieve outcomes within these target populations.

707 **Glossary**

708 **Adults.** Individuals, 18 years and older, who engage in lifelong learning activities with the aim of
709 enhancing their own knowledge, skills, and competencies from a personal, civic, social, or
710 employment-related perspective.

711 **Citizen Science.** An approach in which volunteers partner with scientists to answer real-world
712 questions. (Source: Citizen Science Central, <http://citizenscience.org>)

713 **Disciplines that support NOAA's mission.** The entire suite of professional disciplines that support
714 NOAA. This includes all NOAA-related sciences, as well as engineering, vessel and airplane
715 operation, nautical charting, policy, graphic design, illustration, communications, law, management,
716 uniformed services, social sciences, and marine observer programs.

717 **Earth system science.** An integrated approach to the study of the Earth that stresses investigations
718 of the interactions among the Earth's components in order to explain Earth dynamics, evolution,
719 and global change. (Source: NASA's Earth Observatory Glossary,
720 <http://earthobservatory.nasa.gov/Glossary/>)

721 **Education.** The process by which individuals develop their knowledge, values, and skills. Education
722 encompasses both teaching and learning. (Source: adapted from The Definitions Project,
723 <http://www.definitionsproject.com/>)

724 **Engagement.** A two-way relationship between a service provider and society. It implies a
725 commitment of service to society through a partnership based on reciprocity and sharing of goals,
726 objectives, and resources, e.g., between NOAA and the society it serves. Implicit to engagement is a
727 respect for each partner that involves listening, dialogue, understanding, and mutual support.

728 **Environmental literacy.** An environmentally-literate person is someone who, both individually
729 and together with others, makes informed decisions concerning the environment; is willing to act
730 on these decisions to improve the well-being of other individuals, societies, and the global
731 environment; and participates in civic life. Those who are environmentally literate possess, to
732 varying degrees:

- 733 • the knowledge and understanding of a wide range of environmental concepts, problems,
734 and issues;
- 735 • a set of cognitive and affective dispositions;

- 736 • a set of cognitive skills and abilities; and
737 • the appropriate behavioral strategies to apply such knowledge and understanding in order
738 to make sound and effective decisions in a range of environmental contexts.

739 (Source: [Hollweg et al. 2011](#))

740 **Environmental stewardship.** The responsible use and protection of the natural environment
741 through conservation and sustainable practices to enhance ecosystem resilience and human well-
742 being. (Source: [Chapin et al. 2011](#))

743 **Experiential learning.** Experiential education programs engage learners in constructing meaning
744 by immersing them in direct and meaningful hands-on experiences. This approach incorporates
745 learning using real-world problems and interaction with natural phenomena. (Source: Association
746 for Experiential Education, <http://www.aee.org/>)

747 **Formal education.** Learning within a structured education system in which children or adults are
748 required to demonstrate proficiency.

749 **Free-choice learning.** Self-directed, voluntary education guided by an individual's needs and
750 interests.

751 **Indigenous knowledge.** The traditions, culture, and belief systems of people whose ancestors
752 inhabited a place or country before persons from another culture or ethnic background arrived on
753 the scene.

754 **Informal education.** Learning outside the established formal system that meets clearly defined
755 objectives through organized education activities.

756 **Lifelong learning.** All learning activity, formal and informal, undertaken throughout life, with the
757 aim of enhancing knowledge, skills, and competencies from a personal, civic, social, or employment-
758 related perspective.

759 **Literacy principles.** Essential knowledge validated by a community of researchers, educators, and
760 policy-makers that is needed to fully understand a specific content area and apply it in daily
761 decision making. The determination and refinement of literacy principles is a dynamic, on-going
762 process.

763 **Minority Serving Institutions.** Colleges and universities, including state colleges, private schools,
764 religiously affiliated colleges, liberal arts colleges, and community colleges, that have a special focus
765 on serving the needs of a minority audience. These universities have a historical tradition or
766 mandate to serve a specific demographic of student, but often serve non-minority students as well.
767 The term “minority institution” means an institution of higher education whose enrollment of a
768 single minority or a combination of minorities exceeds 50 percent of the total enrollment. (Source:
769 [U.S. Department of Education, 20 U.S.C. § 1067k\(3\)](#))

770 **Native science.** The knowledge held by indigenous people around the world that has been
771 gathered, adapted, refined, and transmitted following precise protocols, traditions, and values
772 maintained since before written history. The core of Native science is interdependencies and
773 relationships that make up the whole. (Source: adapted from the Native Science Academy
774 definition, <http://www.silverbuffalo.org/NSA-NativeScience.html>)

775 **NOAA Education.** Education efforts undertaken by NOAA-supported programs.

776 **NOAA Education community.** Individuals who engage in education activities on behalf of NOAA.

777 **NOAA-related science.** The collection of scientific disciplines that NOAA employs in its
778 investigations, monitoring, evaluating, and forecasting of conditions and trends in the ocean, coasts,
779 Great Lakes, weather, and climate and in building understanding of these natural systems and their
780 relationship with human activities.

781 **Outreach.** Opportunities designed to build awareness, develop relationships, and inspire action
782 (e.g., pursuit of further learning opportunities, behavioral change). Involves information exchange
783 between provider and target audience. Frequently designed to reach diverse audiences, but can be
784 personal and interactive, designed to identify and appeal to an individual’s personal interest or
785 motivation for information. Outreach for education activities are designed to build awareness,
786 develop relationships, promote education products, and inspire educators, students, and the public
787 to pursue further learning opportunities.

788 **Place-based education.** This method of instruction encourages participants to use the schoolyard,
789 community, public lands, and other special places as resources, turning communities into
790 classrooms. (Source: adapted from the Place-based Education Evaluation Collaborative definition,
791 <http://www.peecworks.org/PEEC/Benefits of PBE-PEEC 2008 web.pdf>)

792 **Resilience.** The ability to adapt to changing conditions and withstand and rapidly recover from
793 disruption due to emergencies. (Source: Presidential Policy Directive 8: National Preparedness,
794 <http://www.dhs.gov/presidential-policy-directive-8-national-preparedness>)

795 **Social science.** Academic disciplines concerned with the study of the social life of human groups,
796 and individuals, including anthropology, economics, communications, geography, philosophy,
797 psychology, history, education, outreach, political science, and sociology.

798 **Service learning.** A method under which participants learn and develop through active
799 participation in thoughtfully organized service that is conducted in and meets the needs of a
800 community; is coordinated with an elementary school, secondary school, institution of higher
801 education, or community service program, and with the community; and helps foster civic
802 responsibility; and that is integrated into and enhances the academic curriculum of the students, or
803 the educational components of the community service program in which the participants are
804 enrolled; and provides structured time for the students or participants to reflect on the service
805 experience. (Source: The Community Service Act of 1990)

806 **STEM.** An acronym for science, technology, engineering, and mathematics – disciplines that are
807 crucial to maintaining America’s competitiveness in a rapidly changing global society (Source:
808 National Academies, 2005)

809 **Stewardship education.** Programs and activities specifically designed to educate participants
810 about environmental issues and the connection between human actions and environmental
811 impacts; and that facilitate learning how to practice stewardship behaviors and decisions.

812 **Stewardship behaviors.** Protection, restoration, and conservation actions, sustainable practices,
813 and civic engagement activities that help prevent or mitigate environmental threats.

814 **Student opportunities.** Internships, grants, scholarships, fellowships, and educational programs
815 provided to students on a competitive basis for introducing them to careers and to support their
816 pursuit of higher education in disciplines that support NOAA’s mission.

817 **Training.** A process of transferring knowledge and skills using standardized instructional methods
818 and techniques to targeted professional audiences for the purpose of developing and enhancing
819 professional competencies.

820 **Underserved audiences.** Individuals and groups who have traditionally not had access to
821 environmental education or interpretive programs, activities, or experiences. (Source: adapted
822 from the National Association for Interpretation)

823 **Underrepresented audiences.** Demographic groups that have disproportionately less
824 representation in specific workforce occupations than in the general populace.

825 **Workforce development.** Education, employment, and job training systems designed to provide
826 the skilled workers that employers need to succeed and the education and training that individuals
827 need to succeed in today's labor market. (Source: National Governors Association, 2008)

828 **Youth.** Individuals, younger than 18 years old, who engage in lifelong learning activities with the
829 aim of enhancing their own knowledge, skills, and competencies from a personal, civic, social, or
830 employment-related perspective.

831 **References**

- 832 Bureau of Labor Statistics (2014). Occupational Outlook Handbook. United States Department of
833 Labor. <http://www.bls.gov/ooh/a-z-index.htm>.
- 834 Chapin, F. S., S. R. Carpenter, G. P. Kofinas, et al. (2010). Ecosystem Stewardship: Sustainability
835 Strategies for a Rapidly Changing Planet. *Trends in Ecology and Evolution*, 25(4).
836 [http://dash.harvard.edu/bitstream/handle/1/9774650/Clark_EcosystemStewardship.pdf?](http://dash.harvard.edu/bitstream/handle/1/9774650/Clark_EcosystemStewardship.pdf?sequence=1)
837 [sequence=1](http://dash.harvard.edu/bitstream/handle/1/9774650/Clark_EcosystemStewardship.pdf?sequence=1).
- 838 Committee on STEM Education National Science and Technology Council (2013). Federal Science,
839 Technology, Engineering, and Mathematics (STEM) Education 5-Year Strategic Plan.
840 http://www.whitehouse.gov/sites/default/files/microsites/ostp/stem_stratplan_2013.pdf.
- 841 Damerell, P., C. Howe, and E. J. Milner-Gulland (2013). Child-oriented Environmental Education
842 Influences Adult Knowledge and House Behavior. *Environmental Research Letters*, 8(1).
843 <http://iopscience.iop.org/1748-9326/8/1/015016/article?fromSearchPage=true>.
- 844 Duvall, J. and M. Zint (2007). A Review of Research on the Effectiveness of Environmental Education
845 in Promoting Intergenerational Learning. *Journal of Environmental Education*, 38(4).
- 846 Falk, J. and L. Dierking (2010). The 95% Solution. *American Scientist*, 98.
847 <http://www.americanscientist.org/issues/feature/2010/6/the-95-percent-solution>.
- 848 Field, H. and P. Powell (2001). Public Understanding of Science versus Public Understanding of
849 Research. *Public Understanding of Science*, 10(4).
850 <http://pus.sagepub.com/content/10/4/421.short>.
- 851 Forbes (2011). Global Diversity and Inclusion: Fostering Innovation Through a Diverse Workforce.
852 Forbes Insights. http://www.forbes.com/forbesinsights/innovation_diversity/.
- 853 Harris Interactive (2011). STEM Perceptions: Student and Parent Study. Commission by Microsoft
854 Corp.
855 <http://news.microsoft.com/download/archived/presskits/citizenship/docs/stemperceptio>
856 [nsreport.pdf](http://news.microsoft.com/download/archived/presskits/citizenship/docs/stemperceptio).
- 857 Hoffman, M. and D. Barstow (2007). Revolutionizing Earth System Science Education for the 21st
858 Century: Report and Recommendations from a 50-State Analysis of Earth Science Education

- 859 Standards. Cambridge MA : TERC Center for Earth and Space Science Education.
860 http://www.oesd.noaa.gov/outreach/reports/noaa_terc_study_lowres.pdf.
- 861 Hollweg, K. S., J. R. Taylor, R. W. Bybee, T. J. Marcinkowski, W. C. McBeth, and P. Zoido (2011).
862 Developing a Framework for Assessing Environmental Literacy. Washington, DC: North
863 American Association for Environmental Education.
864 [http://www.naaee.net/sites/default/files/framework/DevFrameworkAssessEnvLitOnlineEd.](http://www.naaee.net/sites/default/files/framework/DevFrameworkAssessEnvLitOnlineEd.pdf)
865 [pdf](http://www.naaee.net/sites/default/files/framework/DevFrameworkAssessEnvLitOnlineEd.pdf).
- 866 Huntoon, J.E., and M. J. Lane (2007). Diversity in the Geosciences and Successful Strategies for
867 Increasing Diversity. Journal of Geoscience Education, 55(6).
868 <http://www.cmmmap.org/scienceEd/docs/HuntoonandLane.pdf>.
- 869 Institute of Medicine, National Academy of Sciences, and National Academy of Engineering. (2007).
870 Rising Above the Gathering Storm: Energizing and Employing America for a Brighter
871 Economic Future. Washington, DC: The National Academies Press.
872 http://www.nap.edu/catalog.php?record_id=11463.
- 873 Intergovernmental Panel on Climate Change (IPCC) (2013). Climate Change 2013: Mitigation of
874 Climate Change. Contribution of Working Group III to the Fifth Assessment Report to the
875 IPCC. <http://www.ipcc.ch/report/ar5/wg3/>.
- 876 Marybow, N. C., D. Begay, L. Peticolas, J. Stein, and S. Valdez (2012). The Cosmic Serpent: Bridging
877 Native Ways of Knowing and Western Science in Museum Settings.
878 <http://cosmicserpent.org/uploads/downloadables/CS-LegacyDoc27Nov2012.pdf>.
- 879 Melillo, J. M., T. C. Richmond, and G. W. Yohe, Eds., (2014). Climate Change Impacts in the United
880 States: The Third National Climate Assessment. U.S. Global Change Research Program.
881 <http://nca2014.globalchange.gov/report>.
- 882 National Academy of Engineering and National Research Council (2014). STEM Integration in K-12
883 Education: Status, Prospects, and an Agenda for Research. Washington, DC: The National
884 Academies Press. [http://www.nap.edu/catalog/18612/stem-integration-in-k-12-](http://www.nap.edu/catalog/18612/stem-integration-in-k-12-education-status-prospects-and-an)
885 [education-status-prospects-and-an](http://www.nap.edu/catalog/18612/stem-integration-in-k-12-education-status-prospects-and-an).
- 886 National Governors Association (2008). Workforce Development Definition. <http://www.nga.org>.

- 887 National Oceanic and Atmospheric Administration (NOAA) (2010). NOAA's Next Generation
888 Strategic Plan, 2009-2014. <http://www.ppi.noaa.gov/ngsp/>.
- 889 National Research Council (2010). NOAA's Education Program: Review and Critique. Washington,
890 DC: The National Academies Press. [http://www.nap.edu/catalog/12867/noaas-education-](http://www.nap.edu/catalog/12867/noaas-education-program-review-and-critique)
891 [program-review-and-critique](http://www.nap.edu/catalog/12867/noaas-education-program-review-and-critique).
- 892 National Research Council (2010). Rising Above the Gathering Storm, Revisited: Rapidly
893 Approaching Category 5. Washington, DC: The National Academies Press.
894 [http://www.nap.edu/catalog/12999/rising-above-the-gathering-storm-revisited-rapidly-](http://www.nap.edu/catalog/12999/rising-above-the-gathering-storm-revisited-rapidly-approaching-category-5)
895 [approaching-category-5](http://www.nap.edu/catalog/12999/rising-above-the-gathering-storm-revisited-rapidly-approaching-category-5).
- 896 National Research Council (2012). A Framework for K-12 Science Education: Practices, Crosscutting
897 Concepts, and Core Ideas. Washington, DC: The National Academies Press.
898 [http://www.nap.edu/catalog/13165/a-framework-for-k-12-science-education-practices-](http://www.nap.edu/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts)
899 [crosscutting-concepts](http://www.nap.edu/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts).
- 900 NOAA (2000). Discovering Earth's Final Frontier: A U.S. Strategy for Ocean Exploration: The Report
901 to the President's Panel on Ocean Exploration. Washington, DC: NOAA.
- 902 Ocean Research Advisory Panel (2013). Leverage Ocean Education Opportunities: A Report to the
903 National Ocean Council. [http://www.nopp.org/wp-content/uploads/2010/06/Leveraging-](http://www.nopp.org/wp-content/uploads/2010/06/Leveraging-Ocean-Education-Opportunities.pdf)
904 [Ocean-Education-Opportunities.pdf](http://www.nopp.org/wp-content/uploads/2010/06/Leveraging-Ocean-Education-Opportunities.pdf).
- 905 Payne, D. L. and J. Y. Baek (2014). NOAA Education Partnerships 2013 Portfolio Review Final
906 Report. Washington, DC: NOAA.
907 [http://www.oesd.noaa.gov/leadership/edcouncil/docs/partnerships/Partnerships2013Po-](http://www.oesd.noaa.gov/leadership/edcouncil/docs/partnerships/Partnerships2013PortfolioReview-FinalReport.pdf)
908 [rtfolioReview-FinalReport.pdf](http://www.oesd.noaa.gov/leadership/edcouncil/docs/partnerships/Partnerships2013PortfolioReview-FinalReport.pdf).
- 909 Penuel, W. R., M. Bienkowski, C. Korbak, A. Molina, D. Russo, Y. Toyama, et al. (2005). GLOBE Year 9
910 Evaluation: Implementation Supports and Student Outcomes. Menlo Park, CA: SRI
911 International. [http://www.sri.com/work/publications/globe-year-9-evaluation-](http://www.sri.com/work/publications/globe-year-9-evaluation-implementation-supports-and-student-outcomes)
912 [implementation-supports-and-student-outcomes](http://www.sri.com/work/publications/globe-year-9-evaluation-implementation-supports-and-student-outcomes).
- 913 Place-based Education Evaluation Collaborative (2010). The Benefits of Place-based Education: A
914 Report from the Place-based Education Evaluation Collaborative (Second Edition).
915 <http://Tinyurl.com/PEECBrochure>.

- 916 Robinson, L., J. Rousseau, D. Mapp, V. Morris, and M. Laster (2007). An Education Partnership
917 Program with Minority Serving Institutions: A Framework for Producing Minority Scientists
918 in NOAA-Related Disciplines. *Journal of Geoscience Education*, 55(6).
- 919 Tai, R. H., P. M. Sadler, and J. J. Mintzes (2006). Factors influencing college science success. *Journal*
920 *of College Science Teaching*, 35(8).
921 [http://svsd.schoolwires.net/cms/lib05/WA01919490/Centricity/Domain/457/research_a
ns_teaching_article_fc.pdf](http://svsd.schoolwires.net/cms/lib05/WA01919490/Centricity/Domain/457/research_a
922 ns_teaching_article_fc.pdf).
- 923 The Native American Academy. Explorations into Native Science: Principles of Native Science.
924 <http://www.silverbuffalo.org/NSA-NativeScience.html>.
- 925 The Ocean Project (2014). An Ocean of Opportunity: Inspiring Visitors and Advancing Conservation.
926 [http://theoceanproject.org/wp-content/uploads/2015/01/OceanOfOpportunities-
SummaryReport2014.pdf](http://theoceanproject.org/wp-content/uploads/2015/01/OceanOfOpportunities-
927 SummaryReport2014.pdf).
- 928 U.S. Commission on Ocean Policy (2004). An Ocean Blueprint for the 21st Century Final Report of
929 the U.S. Commission on Ocean Policy. Washington, DC: U.S. Commission on Ocean Policy.
930 [http://govinfo.library.unt.edu/oceancommission/documents/full_color_rpt/welcome.html
#final](http://govinfo.library.unt.edu/oceancommission/documents/full_color_rpt/welcome.html
931 #final).
- 932 U.S. Department of Education (2011). United States Code 20 U.S.C. § 1067k(3).
933 [http://www.gpo.gov/fdsys/pkg/USCODE-2011-title20/html/USCODE-2011-title20-
chap28-subchapIII-partE-subpart3-sec1067k.htm](http://www.gpo.gov/fdsys/pkg/USCODE-2011-title20/html/USCODE-2011-title20-
934 chap28-subchapIII-partE-subpart3-sec1067k.htm).
- 935 U.S. Dept. of Commerce and U.S. Dept. of Education (2008). The Shortage in the Number of
936 Individuals with Post-baccalaureate Degrees in Subjects Related to Fishery Science. NOAA
937 Tech. Memo. NMFS-F/SPO-91. <http://caribbeanfmc.com/pdfs/ShortageOfDegrees.pdf>.
- 938 U.S. Global Change Research Program (2012). The National Global Change Research Plan 2012-
939 2021. Washington, DC: U.S. Global Change Research Program.
940 <http://downloads.globalchange.gov/strategic-plan/2012/usgcrp-strategic-plan-2012.pdf>.
- 941 Zint, M., A. Kraemer & G. E. Kolenic (2014). Evaluating Meaningful Watershed Educational
942 Experiences: An Exploration into the Effects on Participating Students' Environmental
943 Stewardship Characteristics and the Relationships between these Predictors of

944 Environmentally Responsible Behavior. *Studies in Educational Evaluation: Special Issue on*
945 *Research in Environmental Education Evaluation*, 41.