Sarah Nuss

Education Coordinator, Chesapeake Bay-VA National Estuarine Research Reserve

Date: May 31, 2018
Time: 3-4pm

National Estuarine Research Reserve System Science Collaborative

COLLABORATIVE SCIENCE FOR ESTUARIES
WEBINAR SERIES

Building Research Skills in K-12 Education: The Virginia Scientists and Educators Alliance

Summary Points:

Sarah Nuss is the Education Coordinator at the Chesapeake Bay National Estuarine Research Reserve in Virginia. She has dedicated her career to bringing marine science to K-12 teachers and students.

Sarah has served as Education Coordinator at Chesapeake Bay-VA Reserve for the past 13 years. Her work enhances student, teacher, and public awareness and understanding of estuaries by providing hands-on, investigative field experiences, curriculum, teacher training programs, and public outreach events.

Sarah has been the project lead for two Science Transfer grants, through the National Estuarine Research Reserve System (NERRS) Science Collaborative, which engaged graduate students, high school students, and teachers in Virginia in coastal science and education.

Building Research Skills in K-12 Education

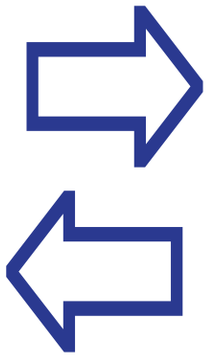
Sarah Nuss
Education Coordinator
Chesapeake Bay National Estuarine Research Reserve in VA

Summary Points:

The webinar is broken into two sections. The first part focuses on the Virginia Educator Scientist Alliance. The second part of the webinar introduces a new education project on climate change.

Why communicate science?

The public needs to become more knowledgeable about science.



Scientists need to become much more involved with and knowledgeable about the public as learners.

Scientists as educators

Summary Points:

Research has demonstrated that Americans have lower scientific literacy than many other countries. Because of this, there have been abundant efforts to bolster STEM (Science, Technology, Engineering and Mathematics) programs in U.S. schools.

The Next Generation Science Standards (released in 2013) identified a significant national need for teaching and professional development resources to help teachers better demonstrate to their students the research practices of scientists and the application of critical thinking skills.

The best source for understanding current research practice is scientists themselves. However, they often conduct their research isolated from the public and communicate their results among other scientists. They may need some training and encouragement in order to share their research with the public.

Broader Impacts

Potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

Summary Points:

Importantly, scientists are increasingly being required by funders to break out of the paradigm of isolation and produce "broader impacts;" these are efforts to deliver research in a way that benefits society. For instance, NSF requires broader impacts as part of its grant applications, and the requirements for broader impacts have become more specific and tailored in recent years.

At the Virginia Institute for Marine Sciences (VIMS), which is the host for the Virginia Chesapeake Bay reserve, scientists are increasingly coming to educators to look for ways to connect their research to other audiences, such as K-12 students, teachers, and the public; this could be through curriculum writing, professional development, exhibits and displays, or public lectures.

Virginia Scientists and Educators Alliance

VIMS Education Teams

hands-on, investigative field experiences, curriculum and information material, teacher training, and public outreach events

+

North Carolina SciREN model

Created by graduate students at UNC Institute of Marine Sciences and the SciREN teams now include graduate students NC universities.

→

Virginia Scientists and Educators Alliance

Collaboration between Virginia science graduate students and K-12 science teachers to produce classroom lessons based on current research

SciREN

VA SEA

Summary Points:

Educators at VIMS and the reserve have been delivering programs to increase scientific literacy for many years.

One of the programs run by the VIMS Marine Advisory Program was the NSF-funded graduate felllowship program, GK-12, which placed marine science graduate students in local secondary science classrooms. Each graduate student worked with a mentor teacher, enriched the science curriculum with their own expertise and background, and served as a role model for scientific careers. When funding for the program ended, VIMS looked for a way to continue it at a lower cost.

Around the same time, Sarah and her colleagues discovered a program called SciREN, which was created by graduate students at the University of North Carolina and enabled graduate students to create lesson plans that were offered to teachers statewide. After attending one of their lesson plan expos and seeing the results and enthusiasm of both the teachers and the students in SciREN, Sarah's team applied for a Science Collaborative grant to start a similar program in Virginia, which they called the Virginia Scientists and Educators Alliance, or VA SEA.

Virginia Scientists and Educators Alliance (VA SEA)

Summary Points:

VA SEA recruited 14 graduate students from Virginia Sea Grant-affiliated universities to participate in the program. Students came from Old Dominion University, University of Virginia, and VIMS.

The initial group consisted of fewer graduate students than initially envisioned, but the group size ended up being conducive to success.

Objectives

1. Enhance graduate student science communication by providing pedagogical skill training and an opportunity to translate their research into activities for secondary classrooms.

1. Enhance K-12 science curriculum by providing teachers with resources that offer authentic examples of research process and how science is applied to solve problems.

Summary Points:

The program had two objectives:

1. Train graduate students to communicate their research at a level that most people could understand.

2. Increase the research communication skills that students were able to practice by getting current research into the hands of teachers so that it could be used with students. For example, some of the lesson plans that were created focused on the process of science itself, such as how to conduct random sampling.

Project Approach

Fall 2015

Student recruitment; Application review; and Lesson Plan Development workshop

Spring 2016

Draft lesson plans reviewed, edited, and paired with local teacher

Fall 2016

Teacher reviewers tested lesson plans in the classroom and provided feedback

Spring 2017

Final edits to lesson plans and Lesson Plan Expo open to teachers statewide

VA SEA

Summary Points:

The project began in Fall of 2015 when students attended a lesson plan development workshop. They then spent several months designing a lesson plan based on their own research. Chesapeake Bay Reserve and Virginia Sea Grant educators served as advisors.

After drafting lesson plans, each student worked with a secondary science teacher who pilot tested the lesson plan. The teachers provided feedback to the graduate students on the applicability and feasibility of the lessons in the classroom. This was an additional step that the team added from the SciREN model because they wanted teachers to have more input on the feasibility of the lesson before it was finalized.

Students edited lesson plans based on teacher feedback and then shared their work with teachers statewide at a Lesson Plan Expo. There, teachers had the opportunity to discuss the lesson plans with the students and received all 14 lessons for their own classroom use.

Summary Points:

Altogether, the project team has presented or demonstrated lessons from the collection 18 times for over 1,200 students and teachers over the past two years.

The lesson plans have been shared at local, regional, state, and national conferences.

Recently, the team received information about where people are downloading the lesson plans and found that they have had a broad global reach; this was surprising as the project team has not done much advertising of the lesson plans, except through their own programs, their website, and through conference presentations.

Downloads by Activity

Title	Downloads
How Green Is It? Learning Light and Electromagnetic Spectrum Properties By Measuring Algae Subjects: Physical Science, Chemistry, Environmental Science, Life Science Grades: 9-12	79
Sea Turtle CSI: A Graphing Activity Subjects: Life Science / Biology Environmental Science Marine / Ocean Science	65
Earthquakes, Glaciers, and Sediments, Oh My! Subjects: Earth Science, Environmental Science, Life Science/Biology Grades: 9-12	45
Microscopic Hitchhiking: Taking a Trip with Microbes and Plankton Subjects: Life Science / Biology, Environmental Science, Marine / Ocean Science Grades: 6-8	23
Counting Blue Crabs in the Bay! Subjects: Life Science / Biology, Environmental Science, Marine / Ocean Science Grade Level: 6-8	23
Sexual Dimorphism in Shrimp Subjects: Life Science / Biology Grades: 9-12	14
The Watershed Game: Land Use & Water Quality Subjects: Environmental Science, Marine/Ocean Science, Life Science/Biology Grades: 9-12	14
Marine Parasites and Fish: How to Sample and Analyze Subjects: Life Science / Biology, Environmental Science, Marine / Ocean Science Grades: 6-8	13
Wonderful Wetlands: Why do we need them and what can they do for us? Subjects: Environmental Science, Marine/Ocean Science, Life Science/Biology Grades: 9-12	12
Keeping Up with Sea-Level Rise: Salt Marsh Accretion Subjects: Earth Science, Marine / Ocean Science Grades: 9-12	10
Seagrass Survivor Subjects: Life Science / Biology, Environmental Science, Marine / Ocean Science Grades: 6-8	9
Plastic as a Habitat for Bacteria and Human Pathogens Subjects: Life Science / Biology Grades: 6-8	8
Can't Catch My Breath! A Study of Metabolism in Fish Subjects: Environmental Science, Marine/Ocean Science, Life Science/Biology Grades: 6-8	2
Dissecting Data Subjects: Life Science / Biology Grade Level: 6-8	2
Stakeholders of the Chesapeake: Curse of the Eastern Oyster Subjects: Life Science / Biology, Environmental Science, Marine/Ocean Science Grades: 6-8	1

Summary Points:

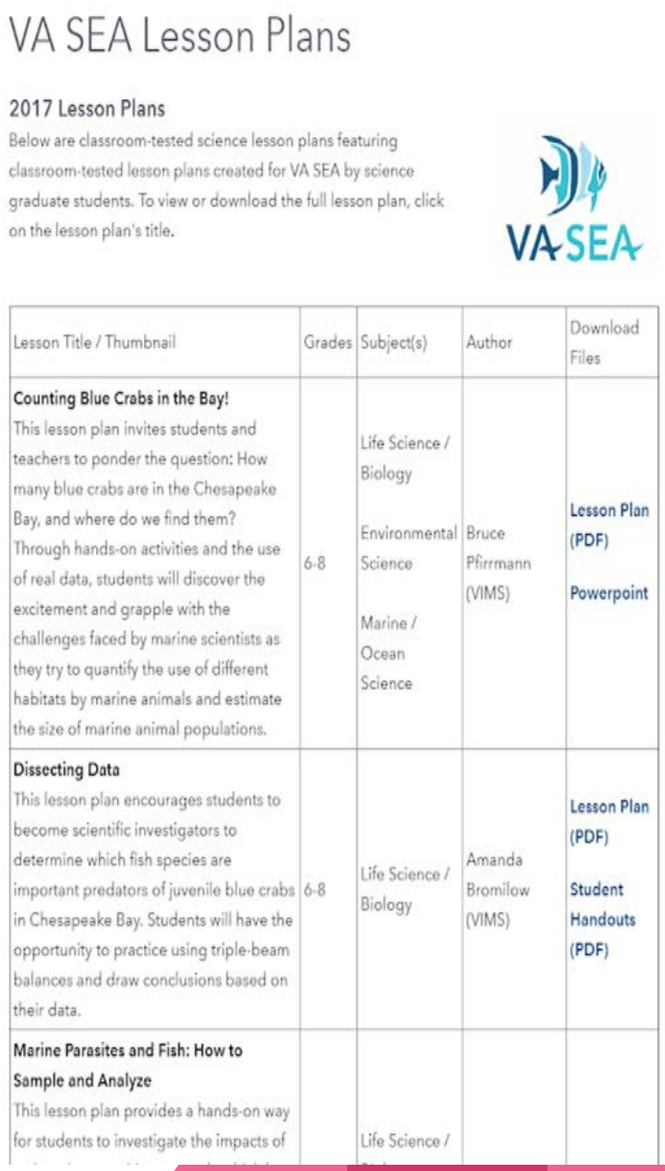
The project team is also able to track which lesson plans have been downloaded most frequently. Although they have not had a chance to analyze this data, they will be working to figure out why some activities are in higher demand than others.

Unsurprisingly, a sea turtle lesson is one of the most popular. But the most-downloaded lesson plan to date is about algae and the spectral properties of light.

Lessons Learned

- End Users
- Partnerships
- Using a model
- Management of graduate students
- Copyright
- Leveraging funds

http://www.vims.edu/research/units/centerspartners/map/education/profdev/VASEA/lessons.php



VA SEA Lesson Plans

2017 Lesson Plans

Below are classroom-tested science lesson plans featuring classroom-tested lesson plans created for VA SEA by science graduate students. To view or download the full lesson plan, click on the lesson plan's title.

Lesson Title / Thumbnail	Grades	Subject(s)	Author	Download Files
Counting Blue Crabs in the Bay! This lesson plan invites students and teachers to ponder the question: How many blue crabs are in the Chesapeake Bay, and where do we find them? Through hands-on activities and the use of real data, students will discover the excitement and grapple with the challenges faced by marine scientists as they try to quantify the use of different habitats by marine animals and estimate the size of marine animal populations.	6-8	Life Science / Biology Environmental Science Marine / Ocean Science	Bruce Pfirrmann (VIMS)	Lesson Plan (PDF) Powerpoint
Dissecting Data This lesson plan encourages students to become scientific investigators to determine which fish species are important predators of juvenile blue crabs in Chesapeake Bay. Students will have the opportunity to practice using triple-beam balances and draw conclusions based on their data.	6-8	Life Science / Biology	Amanda Bromilow (VIMS)	Lesson Plan (PDF) Student Handouts (PDF)
Marine Parasites and Fish: How to Sample and Analyze This lesson plan provides a hands-on way for students to investigate the impacts of		Life Science /		

Summary Points:

Key lessons learned:

1. Having firsthand experience with the needs of the end user audience is an important foundation for collaboration. The project team had ample combined experience through earlier projects (K-12 Needs Assessment, GK-12, and Lawrence Hall of Science's Communicating Ocean Science) and knew this project would fill a niche for both end user groups -- graduate students and teachers.
2. Partnering with another group that provided access to additional teachers, but also relationships with graduate students at universities other than VIMS, was invaluable. Dividing responsibilities, having a clear outline of duties, and giving partners a reasonable estimation of time allotted to the project was also important.
3. Using SciREN as a model allowed the team to develop a program that was a less expensive and time-intensive way to continue the work of the GK-12 program. For example, the team offered stipends to graduate students but did not cover tuition the way the GK-12 program did.

Lessons Learned

- End Users
- Partnerships
- Using a model
- Management of graduate students
- Copyright
- Leveraging funds

http://www.vims.edu/research/units/centerspartners/map/education/profdev/VASEA/lessons.php

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Summary Points:

Key lessons (continued):

4. Budgeting more time for one-on-one interaction between the project team and graduate students would have been beneficial for anticipating and fixing issues that otherwise became bigger problems as they progressed. In addition, graduate students would have benefitted from a more intimate experience with one lead project member, which can help provide a more comfortable environment for voicing concerns or questions.
5. In any project, publishing results and sharing the information widely is one of the key outputs, and the team did not anticipate encountering as many copyright issues as they did. Graduate students used images from the web without permission, so the project team spent a lot of time addressing those issues.
6. Recently, the lesson plans were assimilated into the NERRS Estuary Education website for all of NERRS and teachers nationwide to utilize. While the original intent of the project was to disseminate the lesson plans to the 50+ teachers that attended the lesson plan expo, the lesson plans have now reached a much broader audience.

Questions? Ideas?

Questions:

How were you able to track the lesson plan downloads and create the map you shared a few slides earlier?

The lesson plans were all posted on the VIMS library's website and each lesson plan has a DOI, just like a journal article would. A VIMS librarian was able to generate the map because the plans all essentially had tracking numbers.

Were the participating graduate students in science or education programs?

All of the students were in science graduate programs. The majority were in a Marine Science Master's program at VIMS, although there was one student in a Ph.D. program. The team has discussed the possibility of involving graduate students from the William and Mary School of Education in future years to perhaps review or test lesson plans.

Could you see VA SEA being a feasible model for postdocs at a research institution?

This program could certainly work for postdocs, especially those who are more interested in education and outreach. One potential barrier would be funding. The team gave the graduate student cohort a minimal stipend, which they were all thrilled to receive. However, postdocs may feel differently or require more funding, which may or may not be possible.

But having postdocs participate would be great, since they are further along in their careers and have more data, research, and information to help them create strong lesson plans. One challenge the team faced was that some of the participating graduate students were so early on in their graduate programs that they didn't have a lot of data to work with. This made it challenging for some to develop lesson plans.

Questions? Ideas?

Questions:

Is the program continuing?

The team applied for a grant to do the same project at three other reserves, but it was not funded. However, they are currently on a VIMS faculty members' NSF grant as a broader impact project and if that is funded, they will be able to continue the project for a third year. For this current year (Year 2), they are doing a lower budget iteration of VA SEA, where they will only take 10 students and fund the program internally. However, they are hoping to receive funding in Year 3 to build the program back up.

How many of the students who participated are pursuing careers in education? Do you have any strategies for recruiting them to stay in education/outreach versus scientific research?

One student has transitioned to an education/outreach position and another is working as a fellow with VA Sea Grant in a position that includes outreach. One student is currently working in state government and although he is not working in education/outreach, he commented that his participation in the program certainly helped him improve how he translates technical work to public audiences. But most of the students are still in school or are wrapping up now so it will be interesting to see where they go. The students did recently attend a meeting and sit on a panel to discuss how the project impacted them, and many said they felt more passionately about getting their research out to the public, so that was an exciting result.

Climate Education for a Changing Bay

The overall objective of CECB is to improve climate literacy within local high schools by advancing the use of locally relevant environmental data and information in classroom curriculum, field experiences and professional teacher training. Understanding changes in sea level and inundation, and the associated responses of critical habitats and coastal communities are key to the Chesapeake Bay region.

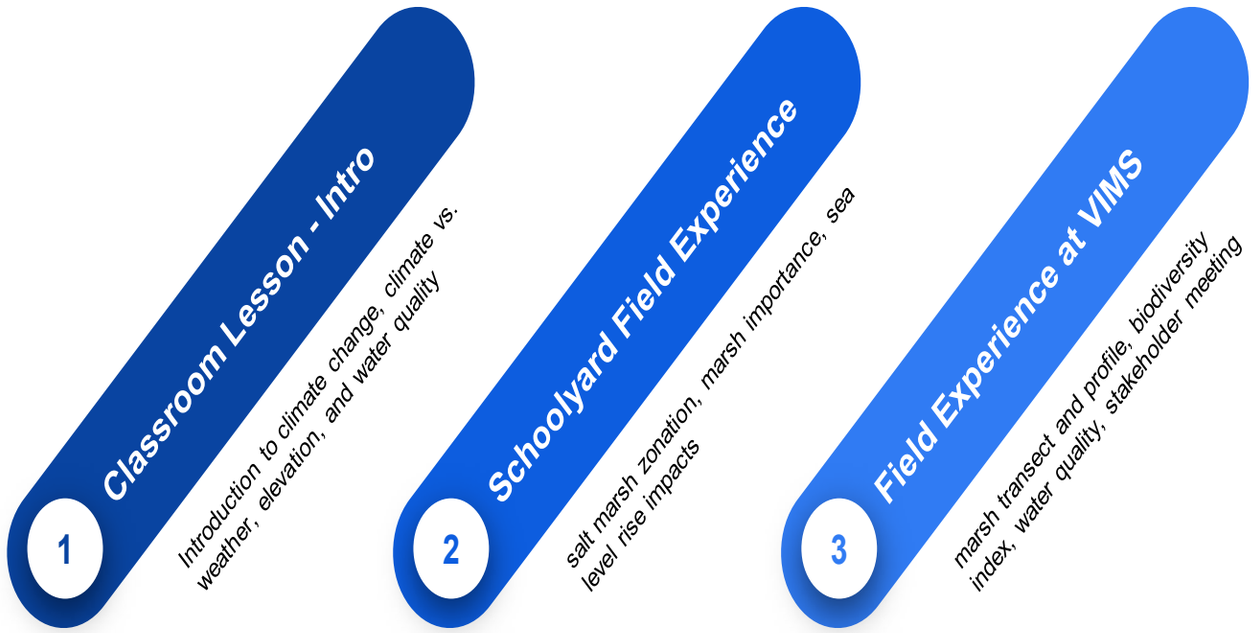
Summary Points:

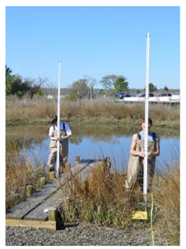
The second program is called Climate Education for a Changing Bay. The project team created the project in 2013 through a NOAA B-WET grant, and currently have funding through the NERRS Science Collaborative to add a teacher mentoring element to the program and allow another county to participate.

The program is aimed at increasing climate literacy in the 9th grade Earth Science classrooms surrounding VIMS. This area is more susceptible to sea level rise and other climate change impacts than many other areas.

The program originated as a result of wanting to share the research going on at the NERRS through their Sentinel Site program. The Sentinel Site Program monitors the reserves for a variety of climate change impacts, especially sea level rise.

Climate Education for a Changing Bay



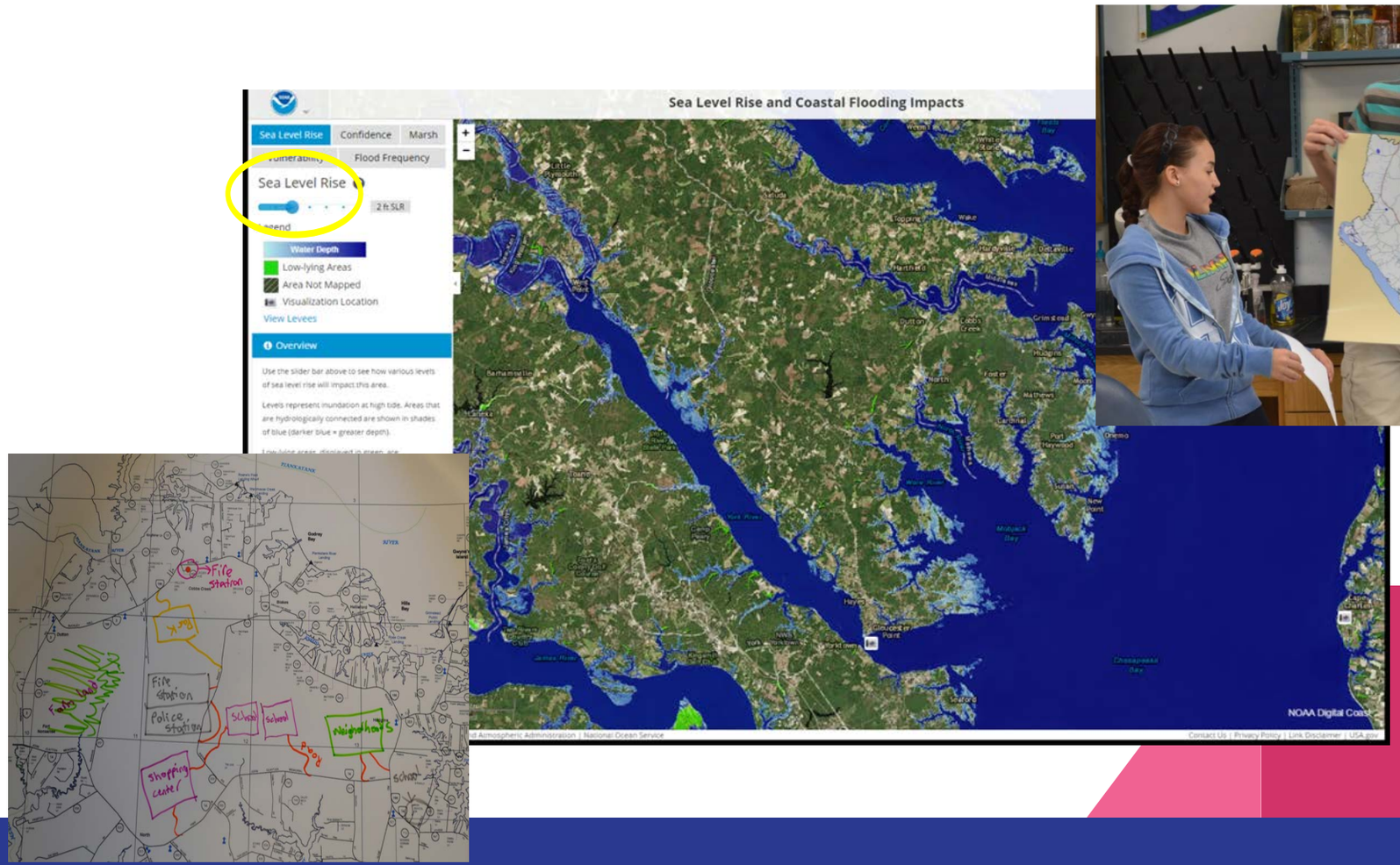


Summary Points:

This program has three distinct components:

1. The students participate in a classroom lesson where they become more familiar with the terms such as “climate” and “weather,” the potential impacts of climate change, and general baseline information about climate change through hands-on demonstrations.
2. The students participate in a schoolyard field experience where they create a mock transect of a marsh (with the poles seen here) and mark several water levels on the poles (mean tide, spring tide, hurricane, projected sea level rise) to visualize the difference in water levels that their area could experience.
3. Students visit Chesapeake Bay reserve to conduct additional studies, such as creating a transect in a marsh with survey equipment and other scientific tools, to study the impacts of sea level rise.

Culminating Research Activity - Stakeholders



Summary Points:

The culminating activity is a stakeholder meeting where students use what they have learned throughout the program to create a new map for their county that outlines changes related to sea level rise; i.e., changes to emergency response routes, shelters, and land planning.

Mentoring

Professional Development

Teachers participate in CECB training - covering basics of climate change plus all key lesson plans

First Year Observation

Teachers observe CBNERR educators as they lead the three lesson plans

Mentoring Only

Teachers complete all three lesson plans on their own. CBNERR available for assistance.

http://www.vims.edu/cbnerr/resources/resources_K12_education.php

Summary Points:

During the first year of the Science Collaborative grant, the team expanded the program to a new county.

In the second year, they tested a mentoring program, which has teachers participate in a professional development workshop in their first year and observe reserve educators in their classrooms leading the activities. During the second year, the teachers receive a stipend to conduct all of the lesson plans on their own.

The project team is pleased to see the results of this project come together as the project wraps up over the next few months. Teachers have already inquired about continuing the partnership with Chesapeake Bay Reserve in the future.

Questions? Ideas?

How can you adapt research similar to this for younger audiences?

What other NERRS or coastal research topics could/should be translated for K-12 audiences?

Questions:

Topics like sea level rise are heavy topics that can be threatening to students. Did these topics weigh on students in your program?
Sometimes it did. The team has had some training on how to communicate about climate change to students, which has helped tremendously. One county they worked with is very conservative, and they had a harder time getting students to believe what they were saying than dealing with students that were really fearful of climate change. But it's important to be careful about how you phrase topics related to climate change, since they certainly can be scary and threatening. That is why the team has not yet adapted this program for younger audiences quite yet.

Do you think we need to teach younger audiences specifically about concepts like sea level rise or should we just be teaching them concepts that will ultimately help them understand those topics better later on, such as volume and temperature?
Teaching young students science process skills that they can build upon is certainly important. But the team hopes to figure out ways that they can get younger students involved in climate change education and action now, without having to go too in-depth on specific topics and threats like property loss.

Thank you!!

Sarah Nuss

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VA SEA Lesson Plans:
http://www.vims.edu/research/units/centerspartners/map/education/profdev/VASEA/lessons.php

CECB Lessons:
http://www.vims.edu/cbnerr/resources/resources_K12_educati[illegible]hp

Questions (cont'd):

We're a small, 3-person team with a large demand for our education/outreach programs. What's the demand on staff time? How willing are teachers to conduct the lessons on their own?
Our education team is also small, which is why we pursued the mentoring model; we could not keep up with the requests to visit classrooms and teach lessons ourselves. It worked because we had already worked with teachers participating in the program (i.e, through prior project) and gave them a small stipend and supplies. However, mentoring and coordinating with teachers was also very time intensive, maybe equally so. We are currently looking to see if this mentoring approach resulted in more long lasting benefits for teachers or students. We are already seeing teachers take more ownership of the lessons and ideas.