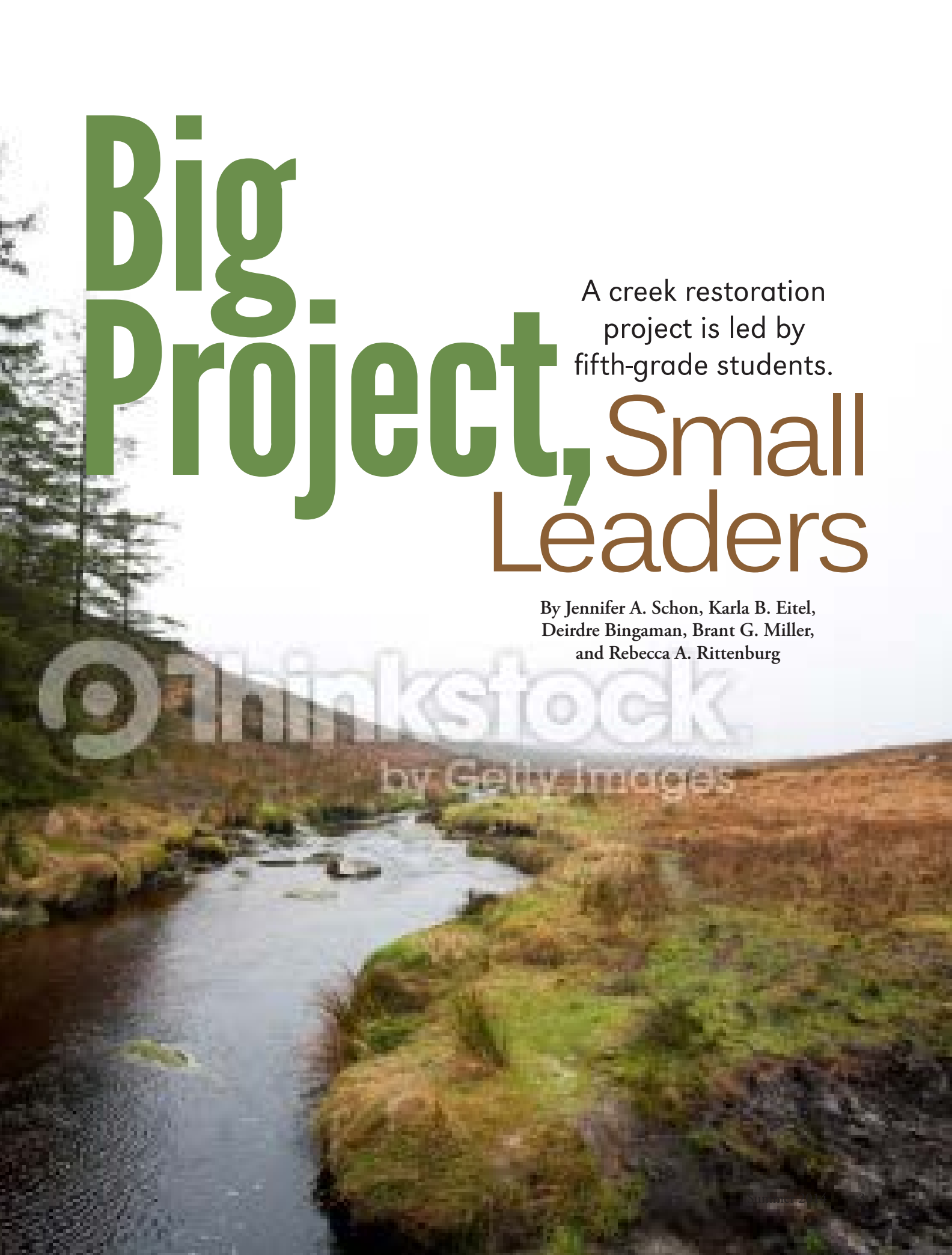
Big Project, Small Leaders

A creek restoration project is led by fifth-grade students.

By Jennifer A. Schon, Karla B. Eitel, Deirdre Bingaman, Brant G. Miller, and Rebecca A. Rittenburg



Fifth-grade students work in small groups along a creek. Some students, donning waders, are carefully recording data, while others are preparing equipment for data collection. Working alongside the fifth-graders are graduate students from the University of Idaho McCall Outdoor Science School (MOSS). MOSS students have been working with Ms. Bingaman's students for several weeks, explaining the water quality characteristics and the methods used to test them. At this point, the fifth-graders are running the show, having had much practice with the skills involved. Not on scene but very much a part of this picture is the greater community, including landowners, parents, and state and government officials of this small town who support the students' work. This network of people was brought together by Ms. Bingaman and her students to help restore Boulder Creek, a creek that travels right by their school in Donnelly, Idaho.

Donnelly, Idaho is a small town surrounded by private ranches and Forest Service property. Through the center of Donnelly runs Boulder Creek, a small tributary feeding into Cascade Lake Reservoir. Boulder Creek originates from a mountain lake north of Donnelly. Since 1994 it has been listed as "impaired" by the Environmental Protection Agency (EPA) for phosphorous loading, high temperatures, low dissolved oxygen, and sedimentation. As a result, many segments of Boulder Creek no longer support any beneficial uses (IDEQ 2009). Because the creek runs behind the school, it is a natural place for students to focus their science study. When the class found out that it was impaired, their studies took on a new level of authentic inquiry as the students sought to assist in monitoring and restoring the creek with the help of local agencies and other partners.

The impetus for pursuing the Boulder Creek restoration project was threefold, resulting from a need for engagement in education, restoration, and community involvement. The partnerships with local agencies and university resources represented in this project can serve as a model to schools anywhere for teachers looking to infuse their curriculum with rich, authentic experiences. The collaboration between schools and local agencies (Idaho Department of Fish and Game, Department of Water Quality, and the National Forest Service) and/or universities also benefits the partners by providing local agencies an opportunity to get more involved with the community. Government agencies often struggle with involving citizens and landowners in restoration projects and securing access to land to conduct their own surveys. This article is an examination of how classrooms, with help from local agencies, can play a role in a restoration effort by collecting data, participating in restoration, and motivating other members of the community to get involved while enriching the science curriculum with an authentic, problem-based approach.

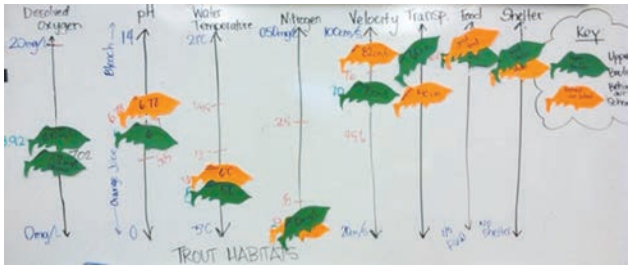
Seeking Help Beyond the Classroom

In the first year, Ms. Bingaman posed the following question to her students, "Boulder creek is impaired. Is there anything we can do?" With her open question, she guided them to become stewards of their creek and to understand their community's impact on it. With help from the community, Ms. Bingaman opened up the endeavor by teaching her students about what a healthy stream looks like and characteristics it needs to sustain a healthy population of trout, the species of fish commonly found in streams in the area. From there Ms. Bingaman discussed the factors in the area that could be negatively impacting Boulder Creek and options for restoration. She was amazed by the response, as the students were overwhelmingly excited that they could play a role in something bigger than them-

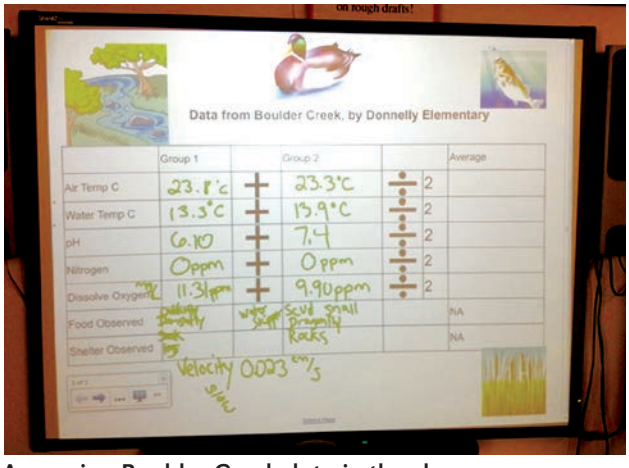
Students collect data from Boulder Creek. A student and graduate student sit at the mouth of Boulder Creek.

selves. They decided to begin by testing the water quality and studying the characteristics of the creek. For many students, there was an intense desire to be involved in protecting their backyard creek. In subsequent years, she has added components to the project, most significantly the Trout in the Classroom component. The students now raise trout in their classroom and release them into the creek (after confirming that testing shows the following conditions are suitable for trout, although not "ideal" for temperature). They are even more invested in the health of the creek as they think of it as habitat for their beloved fish.

Ms. Bingaman knew she couldn't take on this project alone, so she approached faculty and staff at MOSS. MOSS is a field campus that supports a variety of programs including a residential program for K–2 students, where graduate students are the teachers. The MOSS graduate students are immersed in an experiential curriculum, learning to become place-based environmental educators, while serving as field instructors in residential and classroom-based programs. K–12 students that attend MOSS collect water quality data on a weekly basis; Ms. Bingaman saw MOSS as a key partner for making her Boulder Creek restoration project a reality. MOSS provided equipment and knowledge to guide her and her students through the process of tackling the Boulder Creek project. Ms. Bingaman also sought the help of Idaho Department of Environmental Quality (IDEQ), Idaho Department of Fish Game (IDFG), Payette National Forest, and a retired forest service fish biologist. With university and federal partners assisting, Ms. Bingaman has been able to develop a unique, ongoing service-learning experience for her students.



Visual data representation of trout habitat conditions from data collected in Boulder Creek



Averaging Boulder Creek data in the classroom

Every year since the inception of the Boulder Creek restoration project, MOSS graduate students have worked with the Donnelly students to introduce the concepts of water quality testing and healthy trout habitat to determine if their class-raised trout can be released in the creek. After the students have a solid understanding behind water quality characteristics such as pH, dissolved oxygen, and transparency, they head out to the field and collect data. They test two places along Boulder Creek to compare—the source in the mountains and further downstream near their school. The first several years Ms. Bingaman relied on MOSS to supply the testing equipment needed. By leveraging the merits of the project, she has been able to generate $30,000 in external grant funding

Getting Started?

Teachers interested in starting their own Citizen Science or Service Learning Project should first explore their options and surrounding area. Is there some area in need of an improvement or problem to solve in or near the school? Deciding on a question or purpose will then lead to what content needs to be covered and how the steps and results will be communicated to others in the community. Next, teachers can work through how to introduce the topic to entice the students, how to teach the key concepts needed, and then get to work with collecting data and evaluating the findings. For tips on starting a service learning project with your students, see NSTA Connection.

Prior to beginning investigations, some considerations for safety do need to be addressed. If working near bodies of water or using chemicals, check with both the EPA and MDSD for any precautions or warnings. Be sure to investigate the area before bringing students on-site to evaluate for any hazards, such as steep embankments or slippery paths. If using any tools or scientific equipment, inform students of proper handling procedures and warn them of known dangers. All students should be encouraged to dress appropriately for weather conditions and wear adequate clothing for the area they will be working in, including closed-toe shoes.

that has allowed her to purchase waterproof backpacks for each field group, outfitted with everything the students need to collect data. Students collect data on the pH, water and air temperature, dissolved oxygen, nitrates, transparency, velocity, and GPS coordinates of each testing site. With the help of Idaho Fish and Game, students now tag their trout before releasing them into Boulder creek next to the school.

In 2012, Ms. Bingaman's class officially adopted Boulder Creek through the University of MOSS cooperative extension program called IdaH2O Master Water Stewards, a citizen science project. Adopting Boulder Creek has further validated IdaH2O efforts to provide useful data by citizen volunteers, made accessible to government agencies. Ms. Bingaman's class has also started a science blog, with help from MOSS, where students post commentary, photos and videos of their experience (see Internet Resource). Recently students used an underwater surveillance camera to survey the release of the class-raised trout and to monitor transitional behavior between captivity and the wild. With the assistance of IDFG leading the tagging of the trout, snorkel surveying for trout population monitoring, and the underwater surveillance camera, students are able to make observations of aquatic life in the creek and, thus, draw conclusions about its health.

Community Benefits

The Boulder Creek project has provided Ms. Bingaman's students with a unique service-learning project empowering them to become the scientists and experts on their local stream, offering a unique learning experience that has incorporated several Common Core State Standards and Next Generation Science Standards (see Connecting to the Standards). Prior to starting this program, Ms. Bingaman's students averaged a score of 62% at the proficient or advanced level in fifth-grade science concepts on the ISAT test (Spring ISAT data of 2007 and 2008). In 2012, her students averaged a 95% proficient or advanced level on the ISAT (Spring ISAT data of 2011 and 2012). But what is most worthwhile is seeing the transition to becoming a more empowered and contemplative 10- or 11-year-old, and hence, someone that can make a difference in their community. As much as the students have benefited from the project, so has the community. Both local residents and local agencies have been rewarded for their efforts in this collaboration.

In 2009, Ms. Bingaman's class received a $5,000 grant from IDEQ to manage a slope stabilization project on the creek that was badly eroding next to their school. Students designed the stream bank restoration, hired local builders, purchased local equipment and supplies, and managed the overall implementation of the slope restoration. After researching options, the students chose a log-grid design and began calling around to price out the needed materials. The small community benefited from this project not only from the stream bank restoration but also from the economic stimulus the grant money provided. For example, students collectively decided to use the grant for local supplies and services to support their community, using this as seed money to expand the impact of their project.

Early on in the project, Ms. Bingaman's students decided that the city should know about their project and the condition of the creek. Each year her students prepare a presentation for the Donnelly City Council inform-

Collecting data in the field with a mayfly.

ing them of the current water quality status of the creek. The impact of the project is also evidenced by stakeholder support throughout the life of the project, which has required a larger and larger venue to accommodate interested community members at the council meetings. Community members, including local government agencies and elected officials, have voiced their support for the good work of students.

Previously both IDEQ and IDFG employees struggled to garner respect from landowners to be granted access. Both IDEQ and IDFG had tried unsuccessfully to be allowed onto private residents' properties to work on restoration projects, even though there would be no cost or time requirements required of the landowners (IDEQ and IDFG would bringing their own supplies and volunteers). IDFG and IDEQ share similar interests—poor quality of water and eroding land reduce wildlife's chance of success and impact human health. After seeing the effort the students were putting into restoring the creek, a local landowner reached out to IDEQ and agreed to work with them on improving the erosion on his land. Soon thereafter, one of the largest landowners in the area donated acreage to a project that helped create trail access throughout town and offered another access point for students to work on the creek.

The result of community members hearing and seeing the effort of these students has led to several other landowners allowing local government agencies to work on their land, broadening the effort to restore Boulder Creek. Although landowners can understand and appreciate this ecological concern, it wasn't until Ms. Bingaman's fifth-graders graders became involved that they were then willing to open their doors to government agencies and reimagine their role as a small part of a bigger picture to restore Boulder Creek. The students acted as a bridge to the landowners and government officers. The Donnelly area IDFG and IDEQ found a lack of formal agreements and therefore a casual but personal relationship is what helped to create trust with local landowners. An IDFG officer remarked, "We try to form relationships by handshakes ... we might not get [consent] otherwise." Thus, students have played a vital role in instilling trust. An IDEQ employee acknowledged the students' impact when she said: "Without the students, I think we would see little community participation." She added, "Those little kids have a tremendous role; that's what did it, that is how we got our foot in." As a result of cultivating a relationship with government agencies, Ms. Bingaman can now count on IDFG, the Nez Perce Tribal Fisheries, DEQ, and Payette National Forest to do annual fish dissection lessons, help with tagging and releasing of the classroom trout, and conduct field research with her students.

Conclusion

Students have become scientists, landowners have become stewards, and IDFG and IDEQ officers have been welcomed onto private land. In a small, rural town such as Donnelly, Idaho, it is clear that students and teachers inspired to cultivate change can have a big impact on the local community. An impaired creek and a motivated teacher and students are the catalyst for a community-wide restoration effort and lessons that can last a lifetime. From this service-learning project fifth-grade scientists have acquired multiple science, math, and speaking skills, brought many community entities together, and are working to restore their local creek. ■

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References

Idaho Department of Environmental Quality (IDEQ). 2009. Cascade Reservoir Watershed Phase III Water Quality Management Plan and TMDL Five-Year Review. Idaho Soil and Water Conservation Commission. *http://swc.idaho.gov/media/8946/cascade_reservoir_cascade_reservoir_five_year_review_final_0209.pdf.*

Internet Resource

Adventure Learning Donnelly Elementary blog
http://adventurelearningat.com/donnelly-elementary

Connecting to the Standards

Standard 5-ESS3 Earth and Human Activity

Performance Expectation:
5-ESS3-1 Obtain and combine information about ways individual communities use science to protect the Earth's resources and environment.

Science and Engineering Practice:
Obtaining, evaluating, and communicating information

Disciplinary Core Idea:
Human impacts on Earth systems

NGSS Table: 5-ESS3 Earth and Human Activity
www.nextgenscience.org/5ess3-earth-human-activity

Standard 5-LS2 Ecosystems: Interactions, Energy, and Dynamics

Performance Expectation:
5-LS2-2 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Disciplinary Core Idea:
LS2.A Interdependent Relationships in Ecosystems

Crosscutting Concept:
Systems and System Models

NGSS Table: 5-LS2 Ecosystems: Interactions, Energy, and Dynamics
www.nextgenscience.org/5ls2-ecosystems-interactions-energy-dynamics

Common Core State Standards

English Language Arts Standards: Comprehension and Collaboration
CCSS.ELA-Literacy.SL.6.1b Follow rules for collegial discussions, set specific goals and deadlines, and define individual roles as needed.
CCSS.ELA-Literacy.SL.6.1d Review the key ideas expressed and demonstrate understanding of multiple perspectives through reflection and paraphrasing.
CCSS.ELA-Literacy.SL.6.2 Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.

Math Content: Understand ratio concepts and use ratio reasoning to solve problems
CCSS.Math.Content.6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
CCSS.Math.Content.6.RP.A.3c Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.

Math Content: Summarize and describe disruptions
CCSS.Math.Content.6.SP.B.5 Summarize numerical data sets in relation to their context.

NSTA Connection

Visit *www.nsta.org/SC1407* for tips on starting a service learning project with your students, the discipline-based inquiry rubric, and notes about safety.