Tackling Invasive Species Using Citizen Science

Connecting student's fieldwork to professional scientists creates real-life results

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By **Sarah Morrisseau** and **Christine Voyer**

SPECIES ARE ON THE MOVE. Whether by human activity, climate change, natural range shifts, or other means, plants, animals, and insects are finding their way to new places across the globe. Some species become invasive in their new homes. They disrupt the ecological balance, reduce biodiversity, or impact our interactions with the environment.

Invasive species scientists and resource managers are charged with identifying and responding quickly to the arrival of potentially disruptive species. They monitor and manage their spread, and investigate impacts on native species, ecosystem processes, and biodiversity. But with so many species on the move and so much land, freshwater, and coastline to cover, the task can move from difficult to downright daunting.

Elementary, middle, and high school students alike can make important contributions to invasive species early detection, monitoring, and research efforts by becoming keen citizen scientists. They can post their own species observations, comments, and multimedia projects to active online communities of peers and professionals across the globe.

We'll show you what this type of learning looks like through the lens of one growing citizen science community in Maine, and how you can use what's happening there as a model and inspiration for empowering your own students as citizen scientists.

An online network of tens of thousands of students and teachers can help to inform and extend scientists' otherwise limited research and monitoring efforts. The nature of the work demands students develop scientific habits of mind: curiosity, observation, questioning, reasoning, and analysis. They use science practices and skills as they collaborate and communicate in person and online with peers and professionals. As citizen scientists, students can learn science by *being* scientists.

What does citizen science look like?

Citizen science learning experiences look different across grade levels, subject areas, ecosystems, and species studied. While the context for learning may change, the underlying process that student scientists go through to make observations, collect data, and connect with and contribute to citizen science communities is quite similar.

Here's an example of what middle school science learning experiences in a freshwater ecosystem can look like. Since 2009, thousands of students from across Maine have been collecting baseline data on native species, alerting scientists to unfamiliar species, and collaborating with professionals to monitor and manage forested, freshwater, and coastal areas that have invasive species.

In Dedham, Maine, Rhonda Tate's grade 8 students are


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in their third year investigating their schoolyard habitats and contributing data to the Vital Signs community. In 2011 Rhonda's students decided to contribute data to "Mission: Rock snot." Rock snot is an invasive diatom known to cover and smother freshwater stream habitat. It is a species not yet seen in Maine, but one that scientists at the Maine Department of Environmental Protection are particularly concerned about for its impact on fish habitat.

Rhonda's students practiced fieldwork skills, and headed to the stream behind their school with a species identification card for rock snot, water quality sampling tools, cameras, GPS units, and datasheets. They made careful observations of the riparian habitat, as well as the texture and color of the specimens that most resembled rock snot. One student team called Equinox thought they found it.

Team Equinox collected both written and visual evidence to support their "we think we found it" claim. Back in the classroom, they finalized their case online. They entered their claim, their supporting photographs and evidence statements, and their field notes into an electronic datasheet on the Vital Signs website.

Their work then underwent an in-class quality check and peer review process. Once Equinox was satisfied with their work and felt that they had made a strong case to support their claim, they hit "publish." When they published, their species observation was made public on the Vital Signs website, and an email notification was immediately sent to Paul Gregory at the Maine Department of Environmental Protection. From his office 90 miles away from Dedham, Paul reviewed the evidence and left Team Equinox this comment: "The setting appears ideal for rock snot, and your description—wool-like texture—got my attention! It's definitely worthy of further scrutiny. Can you mail me a sample for me to share with DEP colleagues? I look forward to receiving your mystery alga!"

He and his colleagues reviewed the sample that Equinox sent by mail. Paul was relieved to leave a final comment for Equinox stating that the algae was not invasive rock snot, but a close relative native to Maine.

Rhonda's students were so excited by their close encounter and their online conversation with Paul that they made a video documenting their experience. They shared that video with the Vital Signs community, and played it for their school board to show how they prefer to learn science.

Get involved with local groups

The learning experience Rhonda's students had—asking a question, doing fieldwork, supporting a claim with evidence, interacting with experts online, and creating media-rich projects—can be replicated in your classroom, wherever it may be.

Keeping Rhonda and her students' experience in mind, here are some key steps to take and resources to use to get your students doing meaningful citizen science research on invasive species.

1. Connect with an online community or database.

To give students' learning real purpose and meaning beyond the classroom, start by connecting with an active citizen science group, an online naturalist community, or a species database.

If you happen to teach in Maine, connect with Vital Signs like Rhonda. If you're not in Maine, find an authentic audience for your invasive species data and projects through platforms such as Texas Invasives, iNaturalist, EDDMapS, iSpot, and ProjectNOAH. Use resources like CitSci.org and SciStarter.com to search for local citizen science projects.

2. Ask a question.

Get your students thinking like scientists, and interacting with professionals who are interested in student-collected data by building your invasive species study around a real research question. Whether in science, math, social studies, or language arts class, investigations are more engaging and authentic when driven and guided by research questions.

- Check newspapers and state websites for species of interest or concern in your area.
- The online community you connect with can help you choose a question and species to look for. Join an invasive species project on iNaturalist or invasive species mission on Project NOAH, or start a new mission and invite others to participate.

3. Practice fieldwork skills.

Once you have chosen your research question, practice fieldwork skills and prepare to observe nature as scientists. Curriculum resources are available for building skills around observation, data collection, species identification, and teamwork, and for using tools like cameras, GPS units, quadrats, and species identification guides. You can have students develop expertise as individuals or in fieldwork teams.

Students typically need tools, scaffolding, and background knowledge to make scientific observations and collect useful information in the field. Asking students to study or create identification resources helps them focus in on relevant and distinguishing characteristics when they are in the field. If you're in the northeastern United States, Go Botany and Vital Signs species identification resources—which have been designed to support novices in the field—can tell you what characteristics to look for, and how to tell your species apart from similar species.

4. Make a claim.

An important part of scientific work is making claims and backing up those claims with evidence. The book *Ready, Set, SCIENCE!* by Sarah Michaels, Andrew W. Shouse, and Heidi A. Schweingruber lists generating scientific evidence

as one of the four strands of science proficiency.

Whichever online platform your students use to share data, design your fieldwork datasheet to guide students through the process of making a claim about the presence of their species. Ask them to collect up to three pieces of photographic, written, or sketched evidence to support their claim. Species identification resources can be used to help students hone in on the evidence they need to make a solid case.

5. Observations peer-reviewed.

Peer review is an integral part of scientific practice, and an important collaboration skill for all learners to develop. Students often need support to have positive and productive experiences entering into these finicky discussions. With the right tools, guidance, and time, students become self-reflective learners, and gain comfort and confidence offering advice and ideas to others. Allowing students the time to engage in peer dialogue lets them improve their data quality and communication skills in class as a precursor to interacting with an online community.

6. Share your data.

Students further hone their scientific communication and thinking skills when they connect with other novices and experts through an online scientific community. Online comments and conversations with scientists and expert naturalists can be empowering to students. Henry Ingwersen, a grade three teacher in Wells, Maine explains; "When my students see the comments that experts made on their Vital Signs observations they've looked at me and said, 'Wow! I'm a scientist! I can do this!' and they feel like a part of the scientific community because they are."

In socially-minded online communities, participants who have developed certain expertise often use comments to mentor and give advice to novices, acknowledge correct species identifications, and share relevant stories and resources. Scientists and managers often encourage participants to collect more data specific to their research. Students often use comments to congratulate teammates and peers, share their own expertise with species identifications, observation, photography, sketching, or evidence-based reasoning, and connect with others who have similar species interests.

Start small and evolve over time.

Experienced teachers maintain that it's best to start small with students' first foray into citizen science. Commit to learning and experimenting together in your first year as you explore local habitats, generate questions of interest, connect online, and get excited about taking part in a real research effort. With a solid foundation, you can easily and quickly evolve and deepen the ways that you participate over time.

Here's how three teachers from the Vital Signs community have personalized citizen science learning experiences for their students, and expanded their work from year to year.

Henry Ingwersen and his grade three students are just beginning to explore and learn together as citizen scientists. He says; "This is really exciting. It's new learning for me. Our idea is to identify as much as we can for native species and then the next question we are researching is, 'What are the invasive species out here in our woods?' And the big question is, 'Are the invasive species a problem to the natives?'"

Pat Parent is in his fourth year immersing his grade seven students in invasive species research. They continue to map the biodiversity on their school campus (a project started in 2009) and have posted two field missions that challenge the community to investigate relationships among invasive purple loosestrife, biological control *Galerucella* beetles, and invasive Japanese beetles. "My classes have a real purpose. We're on a mission on campus, in our communities, and in collaboration with students in other parts of the state. We have the encouragement of scientists and others who comment on and use our findings. Kids are excited about science class, and so am I," says Parent.

Jamien Jacobs' grades five and six students used Vital Signs to document native and invasive species on their small island campus. Then, they got a grant from the Casco Bay Estuary Project, teamed up with professionals at Maine Department of Conservation and the older and younger students at their school. They removed truckloads of invasive bittersweet and planted native gardens. Jacobs shares that "students learned about the complexity of ecosystems science, inventoried and mapped native and invasive species, increased the public's awareness of the effects of invasive species in Maine, and used their knowledge and energy to take action!"

Invasive species offer a rich and authentic opportunity for learning. By connecting online to share data with peers and professionals, students can communicate experiences and expertise across states, nations, and the world, bringing a whole new dimension to invasive species citizen science efforts and online learning environments.

Sarah Morrisseau was instrumental in the early design and growth of the Vital Signs community, and now works for the interactive website development company Image Works in Portland, Maine. **Christine Voyer** is the Vital Signs Science Education Program Manager.

Resources

Ready, Set, SCIENCE! Putting Research to Work in K-8 Science Classrooms (2007), http://www.nap.edu/catalog.php?record_id=11882

From Everyday to Scientific Observation: How Children Learn to Observe the Biologist's World, Catherine Eberbach and Kevin Crowley, Learning Research and Development Center, University of Pittsburgh, Review of Educational Research, Spring 2009, Vol. 79, No. 1, pp. 39–68

(Student-friendly citizen science online communities)

1. Vital Signs, http://vitalsignsme.org
2. iNaturalist, http://inaturalist.org
3. ProjectNOAH, http://projectnoah.org
4. iSpot, http://ispotnature.org
5. Texas Invasives, www.texasinvasives.org
6. Early Detection and Distribution Mapping System, http://www.eddmaps.org
7. SciStarter, http://scistarter.org
8. CitSci.org. ht
9. tp://citsci.org