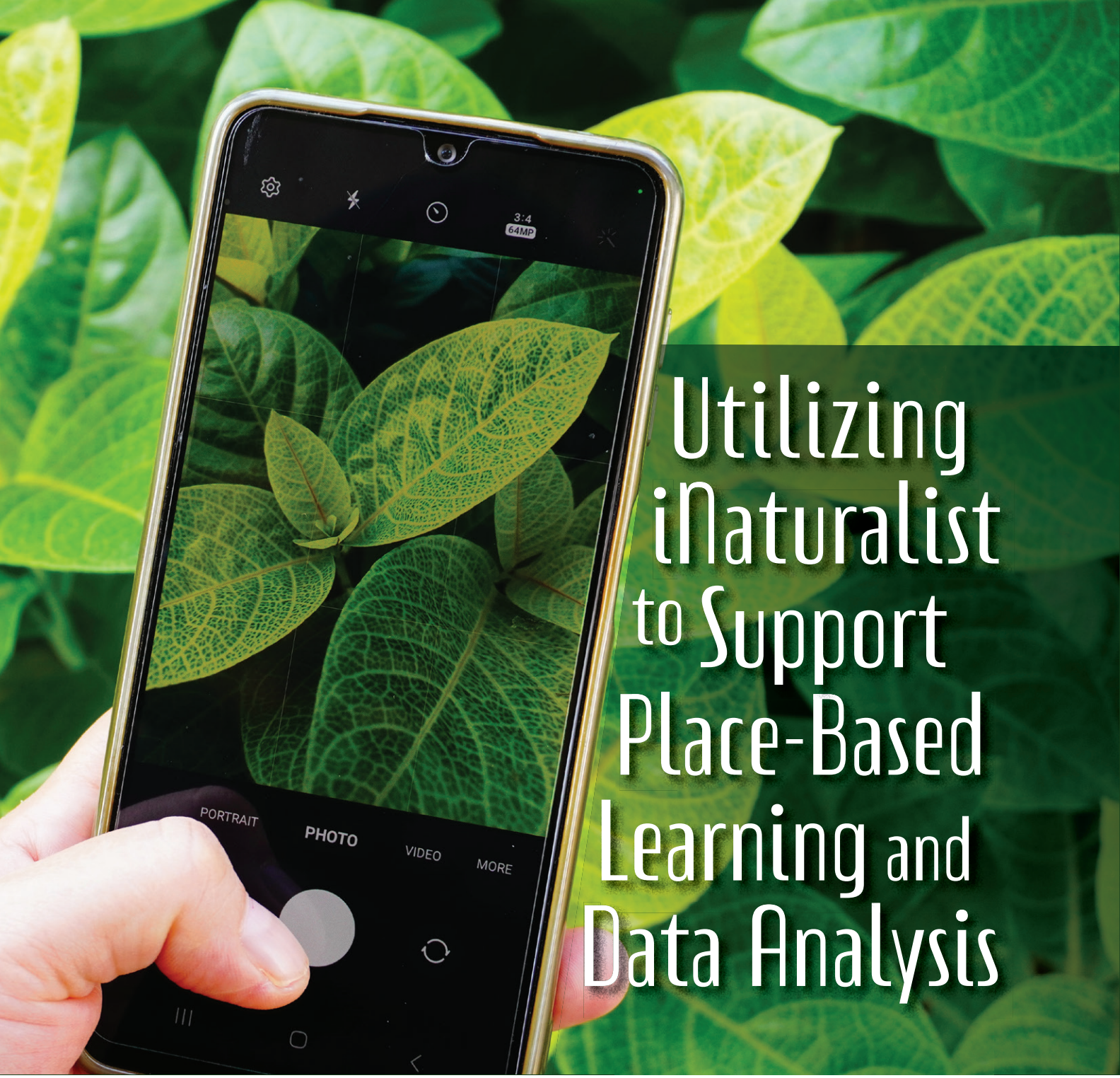


Utilizing iNaturalist to Support Place-Based Learning and Data Analysis

BY AMANDA V. GARNER AND JOSHUA ROSENBERG

Often, we think that to learn about nature, students must be in a "natural" place to experience the environment, but this assumption can be problematic on multiple levels. Not all schools have the resources to take hundreds of students on a field trip. We believe it is a mistake to think that nature only happens in "natural" places. The reality is that nature is everywhere.

Place-based education has a long history of being used with environmental or outdoor education. Drawing on a definition of *place-based* by Ark, Liebtag, and McClennen (2020), we consider

place as not just a geographical location, but also a fluid position wherever we are at any particular time. This includes our community, culture, background, location, and peer groups. Educators and their students spend a more significant portion of their time on a school's campus, so the school campus becomes a central part of their "place." It is practical, in relation to learning and accessibility to resources, to utilize the resources right outside the classroom door (and sometimes, right inside the door).

Place-based learning likely seems appealing but also seems hard to make a reality. Moreover, the kinds of scientific data that students can generate through place-based investigations may seem unwieldy—or impossible to collect. One way to make these big ideas more practical is to use iNaturalist (see link to website in Online Resources), a free global citizen science app intended to collect data on plants, animals, and other life forms. The app works by users uploading observations and requires three users to agree on the identification to become research grade (data usable by scientists). It works based on the collaboration of multiple users to collect data and verify the observations. To use iNaturalist, you just snap a picture and upload an image, and the app can help you identify the organism. We use iNaturalist because it covers all taxa, aligns with state standards, allows students to experience the nature of science, and allows learning to be anchored in data analysis within our schoolyard and community. iNaturalist is also relatively easy to use and provides an excellent tool for place-based learning.

Using iNaturalist

iNaturalist can be accessed through its website (see link in Online Resources) or through the app and is available for both Android and Apple devices. iNaturalist uses image recognition to identify organisms and relies on users to verify the species. Users have the ability to analyze data through the website and can also set up their own projects by defining the research parameters for collecting information on specific taxa or species. The search area can be as large (global) or as small (schoolyard) as you would like. By defining the parameters in a way that best meets your standards and student needs, you can adapt this tool to a multitude of uses so that students can both research and disaggregate data found within the platform.

For example, let's say you are studying the rainforest in the Amazon and you want your students to collect biodiversity data. Your students can go into your project and decide what they want to study. Are they interested in monkeys? They can mark the boxes for mammals and disaggregate from there. Does another group want to know more about insects? They can choose that as well.

iNaturalist does have some drawbacks when using it for education, especially related to student privacy (for student privacy concerns and solutions, view the Teacher's Guide; see link in Online Resources). Setting up a single classroom account that all students can use will solve these issues. With a single account, teachers have the ability to monitor and regulate posts, and it keeps student identities private. With a single account, the

CONTENT AREA

Life Science

GRADE LEVEL

6–8

BIG IDEA/UNIT

Analyzing and interpreting data; human impact on the environment

ESSENTIAL PRE-EXISTING KNOWLEDGE

None

TIME REQUIRED

One 45-minute class period per Bioblitz; varies depending on the class investigations

COST

Free with the use of available technology

SAFETY

Identify hazards (e.g., poison ivy, stinging insect nests), define the areas for students to do observations and/or to identify specific outdoor expectations for the activity.

teacher can also monitor for poor-quality pictures submitted by students. (We recommend dedicating class time to explicitly showing students how to take quality pictures that are required for data use within the app.)

An example lesson

Now that you know how great iNaturalist can be, you might be asking yourself, "How can I use this in my middle school classroom?" In this section, we will address several ways in which you can incorporate iNaturalist into the MS-LS standards and utilize it for place-based activities.

Getting started

Following are ways to prepare students for using iNaturalist:

Setting up an account. First, gain parental permission for students to download and/or utilize the app (if your students do not have access to a cell phone or are not allowed to use them on campus, you can use the website on a computer or tablet). iNaturalist requires parental permission for any child under the age of 13. Most of our students are 13 years old, but we always require a permission slip, even to allow students access to anonymous accounts we have created using our teacher email address. We allow our students, with permission, to create their own accounts because we encourage them to use the app outside of school with their families. We want them to be able to continue their curiosity about nature outside of school and share it with their families. To avoid creating accounts for each student, consider creating a classroom account. Students can all sign into this one account, and you will be the moderator. This way you can give students access and always change the password when the activity is done. This will ensure that the students do not have extended access to the account unless you allow it. A third option is for the teacher and/or teacher assistants to use their devices and take pictures of student finds.

Logging into accounts. Help students sign into their account. If your school uses Google and students have a school account, you can use a single sign-on.

FIGURE 1: Shovel-headed garden worm.

CREDIT: iNATURALIST

Allot time for this step, which can take 5–20 minutes depending on access to a single sign-on or technology skill set. If not, students will need to create accounts with an email address (for privacy, they can create nicknames for their username).

Setting expectations. Explicitly teach the expectations by making sure that you take the time to teach outdoor behavioral expectations and how the app will be used. This is for the safety of your students and to protect any wildlife or plant life within your schoolyard. You will want to explicitly teach behavioral and academic expectations before going outdoors. We do this by modifying classroom expectations we already have in place and adding specific expectations tied to the schoolyard. These include defining the area of study, reinforcing that this is a lab/classroom, and outlining specific hazards that are in our schoolyard—for example, poison ivy,

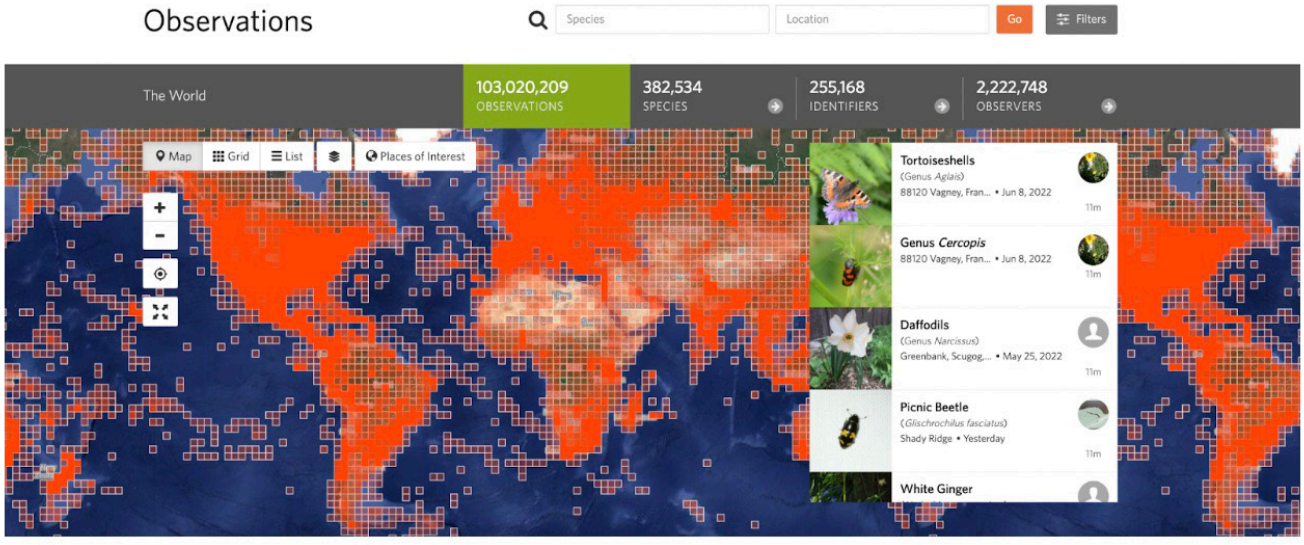
stinging insects, and life near our ponds (see NSTA Field Trip Safety in Online Resources). We take the students outside to our designated area, and as a group, we discuss the expectations and how they would look in an outdoor environment. We also do a practice run, during which we give instructions, students make some visual observations, and we reconvene to discuss how it went. This is an opportunity for students to reflect on the expectations and how they work in the environment.

Selecting a study area. When selecting a study area, choose an area that might have some life. You can choose any area around your school that has plants, insects, or fungi. You can even place a few pieces of wood down in a moist area to create a habitat of insects and gastropods (do this a month or more ahead of a biodiversity inventory, referred to as a BioBlitz). Always scout the area before the BioBlitz. This gives you the opportunity to identify any safety issues. There are always some safety concerns when going outdoors like poison ivy or stinging insects. It is best to be prepared by knowing what is there and incorporating this information into safety expectations before taking students outside. You can choose to avoid that area or teach students how to interact with the hazards. Include any hazards in your teaching of expectations prior to the BioBlitz.

Taking pictures. Model how to take a clear picture for the best chance at identification. You can do this by emphasizing that pictures should be close up and have good focus. Explicitly teach what should be added to iNaturalist. Clarify with students that no human, domesticated animals, or cultivated plants should be included.

Grouping students. Grouping is different with every class we take outdoors. Grouping depends on several factors: access to computers or cell phones, SPED/ 504 accommodations for students, students' diverse learning needs, and student behavior. We usually put students in groups of two to three, and we often have at least one group with a teacher or teaching assistant. The group with the teacher or teaching assistant is generally made up of students who need extra support with confidence, behavior, or accessibility. Also, keep in mind that you should rotate between groups to monitor their progress and help if they need it. Because all students should be within close visual proximity, you can rotate and still keep an eye on other groups. This is also a great activity to invite parents, guardians, or our administration to participate in and help monitor. We limit our BioBlitz area to our sight range (we give students markers such as "do not go past the fence or past the bleachers") to have a smaller area to manage stu-

FIGURE 2: World observations screen.



CREDIT: INATURALIST

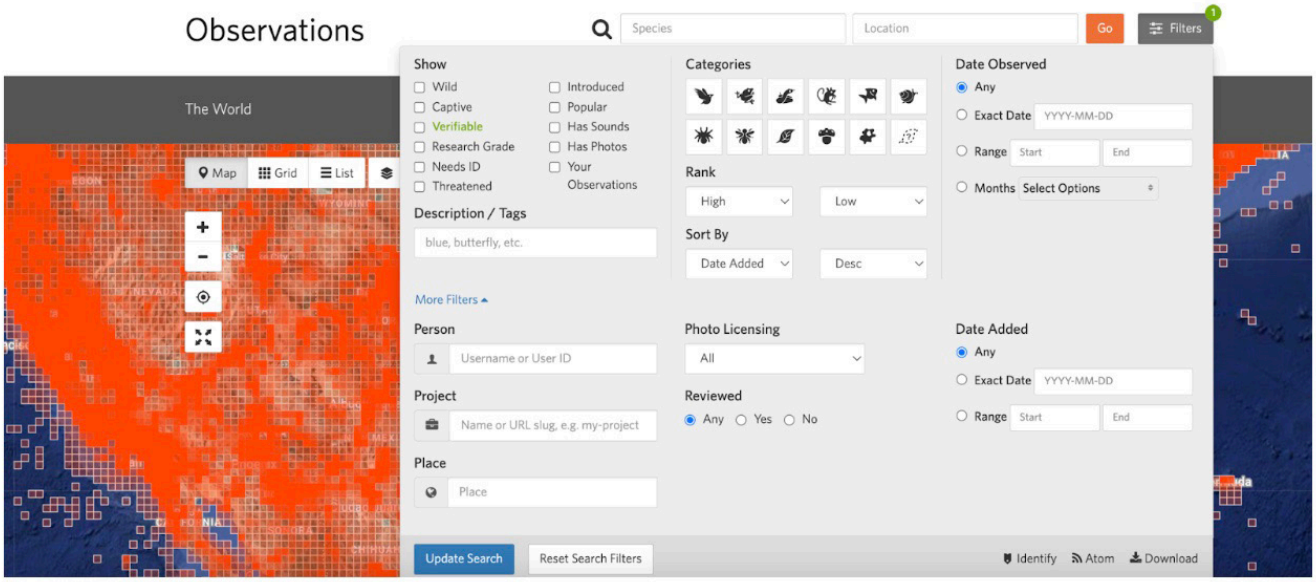
dents. It also allows us to rotate areas, so the students are not all adding the same organism repeatedly or causing excessive damage to a specific spot.

Teaching fieldwork. Take the opportunity at the beginning of the year to teach your students how to do fieldwork. This involves handling or observing organisms. At the beginning of the school year, we teach students how to use nets (sweeping and aerial nets). We show them how to use the nets and how to place the insects into observation jars without touching them. We also teach them about wasps, bees, and other stinging insects and how if those are in their nets, they should not touch them and find a teacher to collect or release them. If they are not sure whether the insect is a stinging one, they are told to always find the teacher to help and not attempt to collect them in the observation jar. We also teach students how to safely observe organisms. When observing, for example, they should keep a safe distance, not touch, and only take pictures. For our aquatic macro invertebrate survey, students are taught how to use the aquatic nets and how to enter and exit the pond. We teach them how to use their net to sweep the bottom of the pond and deposit the macroinvertebrates in tubs of water on the shore without touching them. We explicitly teach them how far to go in the pond, how to walk into the pond, how to exit, and what to do if they get stuck. We also have a safety meeting prior to the inventory to address safety concerns and what to do if a safety concern arises. We recommend this for any type of schoolyard fieldwork. We give students direct instruction and model how we interact with a variety of life in our schoolyard before starting any fieldwork activity. Your level of preteaching depends on what your objective is for your lesson. For example, if the objective is for students to focus on pollinators, you would want to pre-teach the types of pollinators found in your area. If the objective is to catalog as many species as possible, you may want to preteach the interconnectedness of humans and the environment.

A schoolyard-based lesson

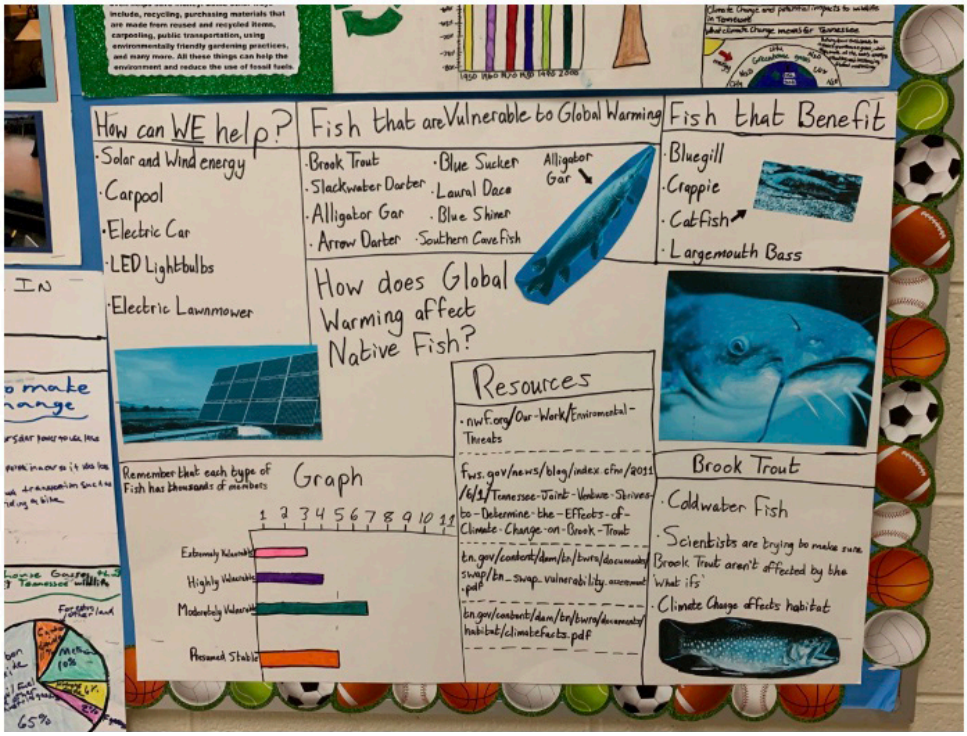
The easiest way to incorporate iNaturalist into a place-based activity is to do a biodiversity inventory, also known as a BioBlitz, of your schoolyard. Essentially, students go outside and document all life they see (except humans). This is a great way to utilize data gathered at your own school. It also provides a nice foundation for the MS-LS2-1 standard by allowing students to gather population information they can

FIGURE 3: Search feature.



CREDIT: INATURALIST

FIGURE 4: iNaturalist-based student project on native fish.



analyze and use to investigate cause-and-effect relationships (Lee, Miller, and Januszyk 2015). If you have BioBlitzes every year, students can use iNaturalist to investigate the connections between weather, human impact, and biodiversity inside your schoolyard.

Before going outside, have a class discussion of what you think you may find. Often, students will underestimate the amount of life on your campus. You can use this as an opportunity to discuss that life comes in all sizes and that they may not see large mammals but will find some gastropods or insects. Your inventory time will depend on the size and scope of the area you are inventorying and knowing how long your students will be engaged. We limit our time to approximately 25 minutes, which includes taking students outside, time spent reviewing, expectations, and observation time.

We do BioBlitzes at the beginning of the school year. We do this as a way to (1) explicitly teach working with live organisms (plants, animals, and fungi) in our schoolyard, (2) reinforce stewardship for our environment, (3) introduce students to our outdoor space and the expectations for working in this space, (4) introduce students to iNaturalist and how to use the app, and (5) practice gathering data and analyzing it to create a foundation for MS-LS2 standards.

For our first BioBlitz, we utilize a resource from the National Geographic Resource Library (National Geographic Society n.d.; see website in reference). This is a simple set of worksheets that allows students to analyze their BioBlitz results. It is a great introduction activity that gives students the opportunity to practice using the disaggregation tools offered by iNaturalist so that they can analyze and graph data. Once they have completed the activity, we share our findings with the class and use them as a springboard for sparking curiosity about the life that is right outside our classroom door. We use the completed set of worksheets as the assessment to determine student understanding of iNaturalist and their ability to analyze data. We also conduct lichen inventories in our schoolyard each year. We docu-

ment our findings using iNaturalist and utilize it to inventory the types and amounts of lichens in our schoolyard. We then use the iNaturalist mapping feature to find evidence of lichen types and to make inferences about the air quality around our school. We also utilize iNaturalist to conduct macroinvertebrate inventories in our school's two retention ponds. The data is used to determine species diversity and the water quality. Each of these experiences gave students the ability to interact with and build relationships with our local environment.

By facilitating our learning through the lens of our local environment, students become more curious. My students have made discoveries that have often directed our learning. For example, on one BioBlitz, my students discovered an invasive species: the shovelheaded garden worm. This led them to research the worm and how it could negatively impact our environment. When we began learning about invasive species (months later), they were immediately engaged because of their previous connection to the shovelheaded worm. Students also discovered a millipede that—when loaded into iNaturalist—turned out to be an uncommon species. This sparked an interest in millipedes and a desire to find more individuals of the species on campus. Several students even looked in their neighborhoods and local parks for it. These experiences have the potential to build a lifelong interest in nature and how we interact with nature (Figure 1).

Connecting the school year with the world

iNaturalist provides global data on species that are easily accessible (Figure 2). Because iNaturalist is a global platform, students can work with large datasets and with variables to narrow in on specific taxa and regions to study. By using iNaturalist to compare local species with other regions globally, students have the opportunity to explore life and understand it in relation to their own backyard. Once students are comfortable using the website and app, they can design their own investigations. For example, if you are studying habitats, students can look at specific regions to identify the abundance of a specific species. They can compare species in their own communities to similar habitats in other regions or countries. The use of iNaturalist can be differentiated based on the level you teach and the needs of your students (Figure 3).

We have also used data from iNaturalist to compare species in our schoolyard to a local National Park. Students used iNaturalist as a research tool to create inquiry projects based on local wildlife and plants. They used the iNaturalist disaggregation tool to identify geographical areas and research species within it, which provided students autonomy by allowing them to choose which type of investigation they were interested in (Figure 4).

Conclusion

Connecting learning to place is an important part of our teaching philosophy. By connecting to our school, community, and learners' lives, science becomes tangible and relevant, making science accessible to all students from all backgrounds. As described in this article, iNaturalist is simple to use and accessible. Moreover, it can support the rich kinds of analysis and interpretation of data that are called for in the *NGSS.*

REFERENCES

Ark, V.T., E. Liebtag, and N. McClennen. 2020. *The power of place: Authentic learning through place-based education.* Alexandria, VA: ASCD.

Lee, O., E. Miller, and R. Januszyk. 2015. *NGSS for all students.* Arlington, VA: NSTA Press.

National Geographic Society. n.d. Analyzing bioblitz data. Available at *https://tinyurl.com/shmw3yu6*

ONLINE RESOURCES

iNaturalist—*https://www.inaturalist.org*

iNaturalist Teacher's Guide—*https://tinyurl.com/5n7vb4ef*

NSTA Field Trip Safety—*https://static.nsta.org/pdfs/fieldtripsafetly.pdf*

Eagleton College and Career iScience Project—*https://tinyurl.com/55kk7prk*

Amanda V. Garner [*avhendricks@gmail.com*] is a middle-grade science teacher and graduate research assistant at the University of Tennessee in Alcoa, Tennessee. **Joshua Rosenberg** is an assistant professor of STEM education in the Theory and Practice in Teacher Education Department at the University of Tennessee, Knoxville.