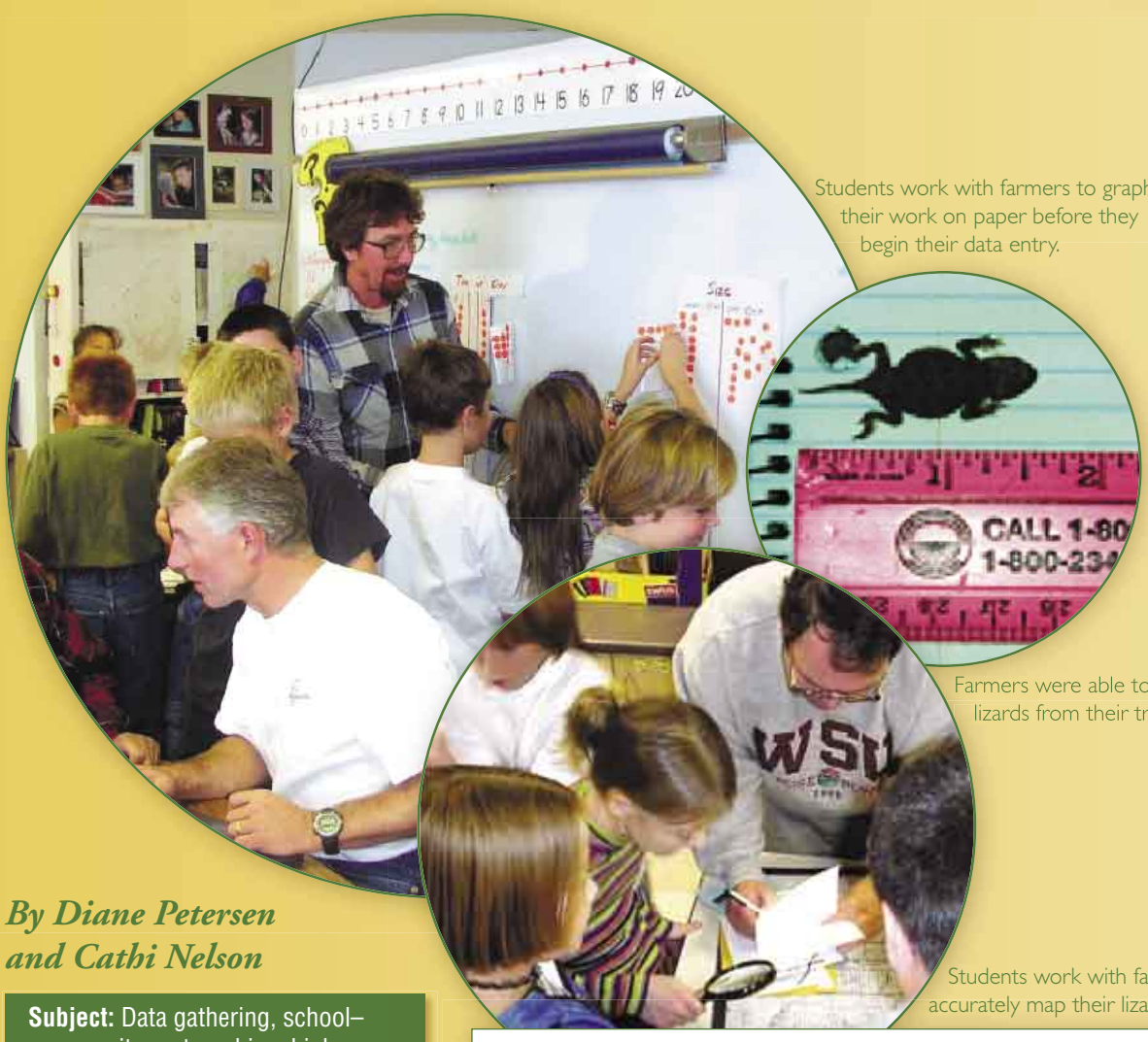
Leaping Lizards and Learning



Photos by: Diane Petersen

Students work with farmers to graph their work on paper before they begin their data entry.

Farmers were able to see these tiny lizards from their tractors.

Students work with farmers to accurately map their lizard sightings.

By Diane Petersen and Cathi Nelson

Subject: Data gathering, school–community partnerships, biology

Audience: Teachers, teacher educators

Grade Level: 2–4 (Ages 7–9)

Technology: GIS, spreadsheet, word processing, and presentation software; Web; digital cameras; GPS units

Standards: *NETS•S* 3–6; *NETS•T* II (http://www.iste.org/standards/). *NSES* Science Content Standards Grades K–4 C (http://books.nap.edu/html/nses/html/).

SHORT-HORNED LIZARD SURVEY DATA SHEET

Date: _____ Time of Day: _____

Temp: ☐ Hot (over 80°) ☐ Warm: (Between 70–80°)

Observer Name: _____

Location: __ Township __ Range __ Section __ Quarter

Latitude: _____ Longitude: _____

Habitat Code: _____

Close to: ☐ farm fields ☐ road ☐ stream ☐ home

How many were there?

Comments: _____

Students designed a form that farmers filled out when they saw a short-horned lizard during their work in their fields.

In the broad fields that stretch toward the horizon in the Columbia Basin region of Washington state, the land is just right for at least two purposes: growing dryland wheat and providing habitat for short-horned lizards, also known as horny toads. Our elementary school, enrolling 150 children from this rural farming community, has become a hub for learning more about the connection between the reptiles and the land they share with farmers.

Cathi and I teamed up a few years ago to design a hands-on, integrated project that would enable students to meet state benchmarks in social studies, math, writing, reading, communication, and science, while also providing them with a solid understanding of how to use technology to gather and analyze data. (Since then, Cathi became school principal.) Students partner with local farmers to collect data on sightings of short-horned lizards. They then use GIS tools and spreadsheets to make maps and graphs to increase understanding of the short-horned lizard and its relationship with the local environment.

How It All Began

Cathi and I had been involved in environmental education projects for our school for many years. For example, we organized a local watershed study, which has successfully collected data for more than 10 years. To further our knowledge about ways to make the data collection serve a real purpose for students, we took a NatureMapping workshop from University of Washington (UW) biologist Karen Dvornich. NatureMapping is a program that links U.S. schools with local natural resource agencies and universities to further knowledge about the environment and natural resources. (***Editor's note:*** Find out about NatureMapping on their Web site. This and other URLs are listed under Resources on p. 33.) Karen visited our school (Waterville Elementary in Waterville, Washington) on a number of occasions. In talking with students, she learned they had seen short-horned lizards in local fields. She was surprised to hear this, because in all the literature, short-horned lizards are not predicted to be found in dryland wheat fields. Perhaps, she thought, this is because we have no data from privately owned land. Questions and rich discussion followed.

Short-horned lizards are common, but their numbers have been in decline in recent years. Karen was excited to find a way to add to the data on short-horned lizard habitats. Karen, Cathi, and I originally thought the students could gather data on the lizards, but we realized that any sightings of the lizards would need to be done in the summer when school was out of session and we would not be available to support students in their data gathering. We realized that farmers would be our best choices for data gathering during the summer. Thus, the Adopt-a-Farmer project was born.

Enlisting Help

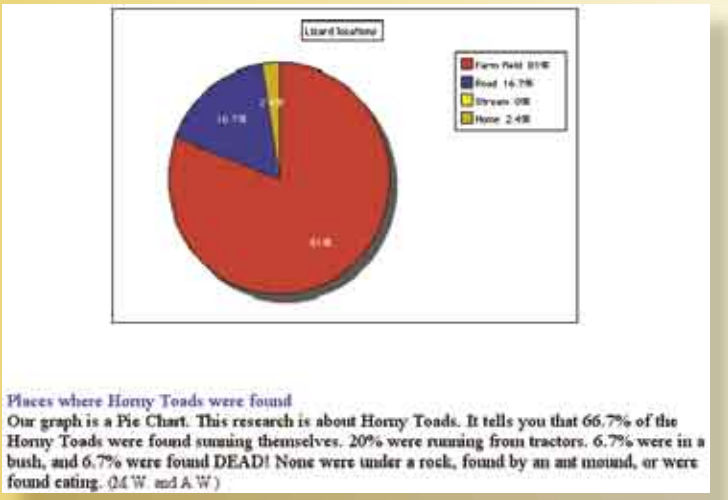
Students brainstormed a list of local farmers they knew and invited them to join us in our research. The students also brainstormed a list of questions to guide the investigation: What does a short-horned lizard eat? When is the best time to see a short-horned lizard? Why do the lizards live in this region of dryland wheat farms?

Students first designed a protocol for gathering field data, then invited willing farmers to a meeting to learn how they could participate in the research project. The students' data-gathering methods included a laminated card with Velcro backing farmers could hang on their tractors. The farmers' job was to collect data on their farmland regarding short-horned lizard sightings including such information as time of day, temperature, size of lizard, exact location, and so on. The students produced a recording sheet and made tablets of them by hand for each farmer. During the summer, farmers recorded all sightings of short-horned lizards as they tilled, planted, and tended their wheat crops. We were really surprised that the farmers could see the tiny lizards from their tractors, but the farmers told us it is the movement they see from their high vantage point. They also made many sightings while on the ground picking rock, walking from vehicle to vehicle, or walking in the fields checking wheat or weeds.

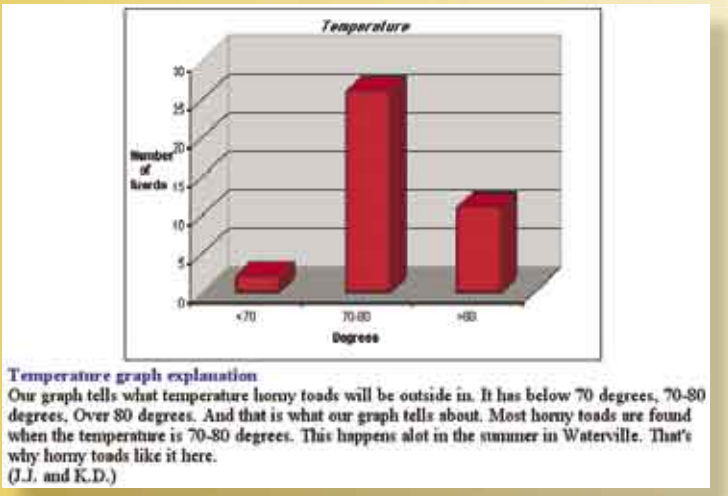
Compiling Data

Each year, about 20 farmers have participated. Each student is paired with a farmer, who they communicate with through a reminder letter, thank-you letter, and phone reminders. This not only gives the kids a real person's data to focus on, it also gives each farmer a feeling of responsibility to that child.

In the fall, when fieldwork is finished and short-horned lizards have begun to hibernate for the winter, we invite the farmers to come to school with their data. On the day of the farmers' visit, farmer/student pairs take the data sheets and go to large paper graphs, putting colored dots in



Places where Horny Toads were found
Our graph is a Pie Chart. This research is about Horny Toads. It tells you that 66.7% of the Horny Toads were found sunning themselves. 20% were running from tractors. 6.7% were in a bush, and 6.7% were found DEAD! None were under a rock, found by an ant mound, or were found eating. (M.W. and A.W.)



Temperature graph explanation
Our graph tells what temperature horny toads will be outside in. It has below 70 degrees, 70-80 degrees, Over 80 degrees. And that is what our graph tells about. Most horny toads are found when the temperature is 70-80 degrees. This happens alot in the summer in Waterville. That's why horny toads like it here.
(J.J. and K.D.)

Students graph their data and post their results on the Nature-Mapping Web site.

the column that represents the correct data, for example, temperature, habitat, or month. Then they find the exact location of each sighting and mark it on a county map using a small sticker. I have found it helpful to use a different sticker each year so we can see patterns develop on the maps. We often overhear students and farmers drawing conclusions and using vocabulary drawn from the field of cartography. The farmers have a knowledge of the maps that is naturally shared with the students as they locate exactly where they found that short-horned lizard! We have found that the farmers are very interested in trends they see on the graphs and the maps: "I wonder if that dot represents the same horny toad as the dot we put on last year, or if it's a baby?"

When the farmers leave, the students go to work inputting the data on the computer. Karen got us copies of ArcView, a powerful mapping and data analysis program, to use in our project. Each dot on the map in ArcView corresponds with a line on the Excel data table, where all the information for that sighting is found. Students take turns with the computers and the data sheets. The process of recording the data onto paper graphs and maps and discussing it with the farmers helps students better understand how to enter the data into the computer.

After they have completed their data entry, each pair of students chooses a type of data to graph (e.g., terrain where short-horned lizards have been found, temperature at the time of the sighting). They proceed to use Excel's graphing wizard to produce a graph—any type of graph the software supports. I ask them a set of questions about their graphs: What is the title? What is the x-axis label? The y-axis label? Tell me three things you can learn from this graph. It becomes apparent very quickly what information they have or have not shown on their graph.

Since the second year of the project, all students learned to make layouts in ArcView. They choose layers of information for a particular farmer and produce a custom map, which may show the farmer's land, sightings, landcover, and county roads, for example. They add titles, compass rose, and legends. Students offer this to their farmer during the spring classroom visit. This is when farmers learn the results of the previous year's data gathering and get instructions for the coming summer.

Communicating the Results

We have two methods of communicating our findings: a poster and a Web site. Students begin by choosing which of their final graphs to use on the poster and Web site. They then write short interpretations of the graphs.

In our first years, Karen made a beautiful poster showing the parts of the project. Recently, students have taken on this task using their skills with Microsoft Word or PowerPoint and the hardware resources made available by grants.

Cathi and I have worked over the years to secure technology grants, including a professional development school grant, a Gates Foundation grant, and a Washington state grant. We've used these funds for various hardware and software purchases, including classroom computers, projectors, laptop and handheld computers, and GPS units.

The Web site (hosted at UW) was the result of a new question posed by the students: How do we share this information with others? I set up the parts of the Web site based on the scientific process and state science standards, and Karen helped the students develop what should go where. We outlined the whole Web site by putting titles and the type of information needed (e.g., a written paragraph, a map, a photo) on chart paper. Then Karen helped students plan what would go on each page. Then students signed up for the tasks on the chart, noting when their tasks were completed. We watched the students organize themselves into a well-oiled team in the school's computer lab in the beginning years. Now, all the work can be done directly from classroom computers.

Our goal is to add our new data to the Web site each year. We now have nearly 300 recorded sightings. The Web site has been part of the NatureMapping site and has been managed by Karen. One of our long-term goals is for students to take over more management of the Web site with training from Karen.

Adding to the Project

Waterville students have continued to meet, to collect data, and to come together to analyze, discuss, and share what they are learning. Teams continue to submit valuable data to the UW NatureMapping project. This year, these same students meet after school once a week to input data, update the Web site, refine the data collection protocol, and redesign posters and presentations.

We have added a few new pieces of technology: a Palm OS handheld with a digital camera attachment and a GPS attachment and three stand-along GPS units. We plan to use them to record exact location with a picture of the site. These can be pop-ups on our ArcView maps.

In an attempt to give students the experience of collecting the short-horned lizard data themselves, we schedule a Saturday field trip to a "likely" site. Students, parents, and teachers collect their own data and see firsthand what short-horned lizard habitat looks like. We use digital images of this field trip to illustrate our poster and Web site. Students also took handheld GPS units to plot exact locations of sightings.

Karen and Dan Hannifous, an ArcView trainer provided through the NatureMapping program, travel to Waterville about three times a year to work with kids, farmers, and teachers. We have learned the parts of the difficult ArcView program on a "need to know" basis. We get an idea and then learn how to use it to help us solve the problem or illustrate the idea. We have barely touched the surface of its capabilities.

Conclusion

The lizard project has given our students many opportunities to use the tools of technology to conduct and disseminate their research. They use digital cameras, handheld computers, spreadsheet software, and mapping software. As they analyze their computer-generated graphs, students discover the essential elements of a graph.

Essential learning in other areas soared, as well. Reading for information is ongoing as students read everything in the literature about short-horned lizards. Classes also meet regularly for scientific discussion.

From our perspective, the project has provided an ideal integration of technology in the classroom. This is the place for technology in their lives—as tools for learning. They use technologies to record data, sort data, manage data, interpret data, and share data in a meaningful way.

More meaning comes from the human interactions that are a natural result of the project. We are overcome with emotion every time we see our classrooms filled with farmers in their overalls and caps, and our little kiddos with their tousled hair, working as equal partners. The elementary students also work alongside researchers from UW and have presented their findings to state groups, scientific conventions, and the local Soil Conservation District board. The students are taken seriously because they know what they are doing, and they collect good data.

The project is a wonderful example of how community members, using consistent data collection procedures and terminology, can learn together and are better prepared to discuss environmental issues with planners.

Resources

ArcView: http://www.esri.com/software/arcgis/arcview/

NatureMapping: http://www.fish.washington.edu/naturemapping/

Waterville Elementary School Short-Horned Lizard Taskforce: http://www.fish.washington.edu/naturemapping/waterville/intro.html

Diane Petersen has taught fourth grade and fourth- through sixth-grade science for the past 13 years at Waterville Elementary School. She holds a bachelor's from Pacific Lutheran University and a master's from Gonzaga University. In addition, she taught first, second, and fifth grades in the Tacoma area and is an adjunct professor of education for Central Washington University. She has received awards for outstanding teaching in science and environmental education.

Cathi Nelson is the principal of Waterville Elementary School, where she previously taught second through sixth grades for 11 years. She also taught third grade in the Monroe and Snohomish districts. She holds a bachelor's and a master's in Curriculum and Instructions from Seattle Pacific University and is an adjunct professor of education for Central Washington University. She has received honors for her work in environmental education and leadership.