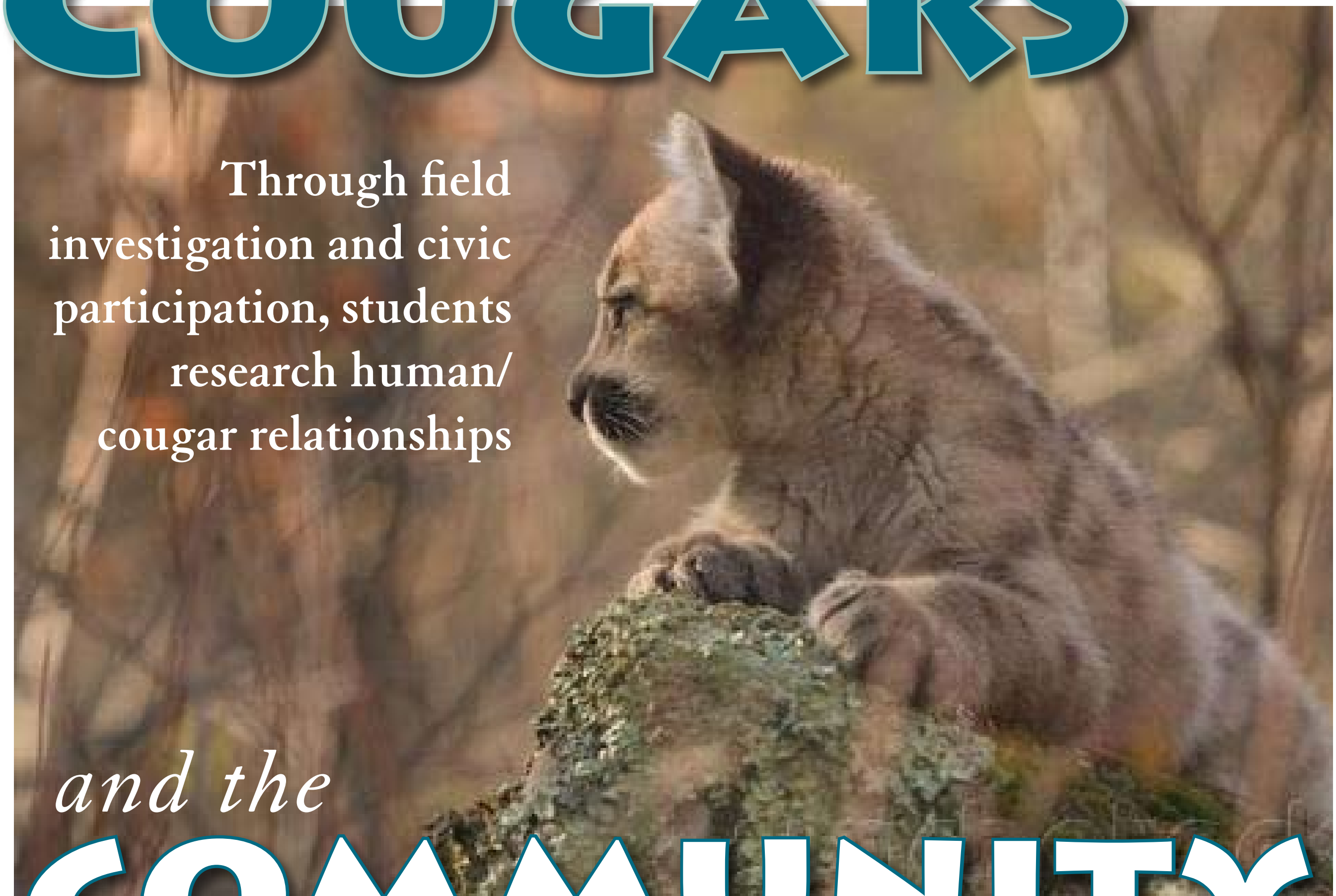
Cougars and the Community



Through field investigation and civic participation, students research human/cougar relationships

Amy E. Ryken, Laura Bowers Foreman, Margaret Tudor, and Gary Koehler

All over the world, big cats are disappearing because humans have not learned to coexist with them. In a research collaboration with government biologists and university educators, K–12 students in the Cle Elum-Roslyn (CER) School District in eastern Washington are investigating where cougars (*Puma concolor)* go when their habitat gives way to new housing developments. Now in its seventh year, Project Cougars and Teaching (CAT) is taking the education and science partnership a step further by incorporating civics into the environmental education curriculum (see "On the web" at the end of this article). Through this model, students become civically engaged by conducting field investigations of the indigenous cougar's ecology and making public presentations to the community.

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This article describes the project's use of two curriculum models—one for field investigations and one for civic participation—in the context of studying human/cougar interactions. These models can also be used to guide other community studies. In addition, the curriculum is a prime example of how a community wildlife problem is bringing together diverse community interests to address a given need (CEE 2002; Quitadamo and Campanella 2005).

Field investigations of natural systems

In 2003, Pacific Education Institute (PEI), an organization involved in Project CAT, convened a panel of experts, including teachers and wildlife biologists working on the project, to define three types of field investigations for science inquiry—descriptive, comparative, and correlative. *Descriptive* field investigations involve describing or quantifying parts of a natural system. In *comparative* field investigations, data is collected on different populations or organisms, or under different conditions (e.g., times of year, locations) to make a comparison. *Correlative* field investigations involve measuring or observing two variables and searching for a pattern (Windschitl et al. 2007).

Many field investigations, regardless of type, begin with counts to gather baseline data; later, measurements are intentionally taken in different locations (e.g., urban and rural, or where some natural phenomenon has created different plot conditions) because scientists suspect they will find a difference based on location. The field investigation model has supported curriculum reform efforts by creating a common language, or inquiry framework, among students, teachers, and scientists.

Using the field investigation model in Project CAT, elementary, middle, and high school students are tracking cougar locations to answer descriptive, comparative, and correlative research questions (Figure 1). All K–12 students involved in the project study cougar prey by reporting elk, deer, and dog locations along rural country roads. While elementary students study natural components of cougars' local environment (e.g., species of fish and wildlife, habitat, water, forests), middle and high school students map cougar locations and study cougar growth and development.

The field investigations that students conduct involve essential features of scientific inquiry (Content Standard A), such as asking "a question about objects, organisms, and events in the environment," planning a systematic approach to data collection, and developing "descriptions, explanations, predictions, and models using evidence" (NRC 1996, pp. 122, 145). In addition, the investigations help students develop skills, such as mapping and perspective-taking, to study community sites (CEE 2002).

A comparative study

In the following sections, the field investigation model is described with a focus on a comparative study of male versus female cougar habitat range. Middle and high school students collect and analyze data through time. Working alongside wildlife biologists, students capture cougars, tag them with global positioning system (GPS) collars—which provide more than 2,000 location readings for each animal per year—mark them with ear tags, and collect physical data (i.e., body length, neck girth, chest girth, weight, and condition of canine teeth). Through these methods, students are able to map cougar locations and study cougar growth and development. They also collect blood for disease analysis and tissue samples for DNA profiling (**Safety note:** See "Safety protocols," p. 38).

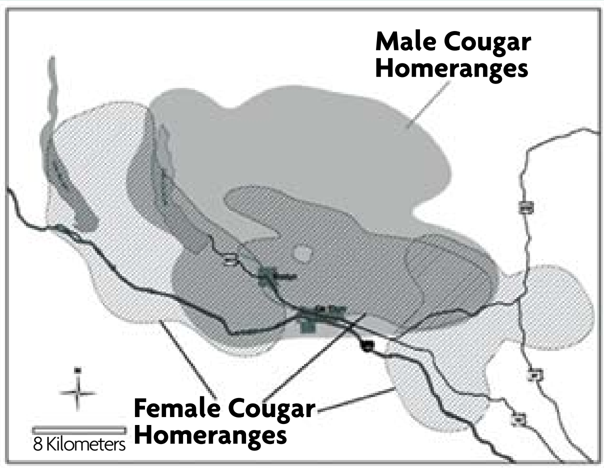
FIGURE 1

Research questions guiding Project CAT field investigations.

Essential question: Where do cougars go when their habitat gives way to a new housing development?	
Field investigation type	**Investigative questions**
Descriptive studies Choose measurable or observable variables.	◆ What areas do cougars select for den locations? ◆ What do cougars eat?
Comparative studies Choose one focus variable to be measured/observed in at least two different locations, times, or populations.	◆ How much space do male and female cougars occupy during each season? ◆ Is there a difference in numbers of deer and elk (cougar prey) killed by male and female cougars?
Correlation studies Choose two continuous variables to be measured together and tested for a relationship.	◆ Do animal tracks increase with greater forest canopy cover? ◆ Is there a relationship between cougar population decreases and human population increases?

FIGURE 2

Map of cougar habitat range in eastern Washington near the city of Cle Elum.



Students go into the field at least once per year—the primary focus of their work is analyzing the GPS data collected remotely. These measurements are then used for all CAT field investigations.

Safety protocols

Student and cougar safety is a top priority in all field investigations. Students are trained in capture, handling, and equipment protocols before participating in data collection. In addition, wildlife biologists are present on all tracking expeditions. Students and community volunteers, under chaperone supervision by a biologist or parent, are kept at a safe distance from the cougar until the animal is sedated. Also, students are continually supervised when working around the sedated cougar and are cautioned about the cougar's sharp claws. Students do not handle any sharp instruments or dangerous materials, such as immobilizing chemicals. When the measuring and inspecting of the cougar is complete, students are chaperoned to a safe distance where they can watch the cougar recover from sedation.

CAUTION

The research process

The GPS collars placed on each cougar collect location coordinates at four-hour intervals throughout the year. After this information has been collected, coordinates for clusters of GPS locations are entered into handheld GPS instruments to help students and the research team navigate to the cluster site and investigate what may have attracted the cougar to the location. Evidence of prey remains (e.g., bones, skulls, and hair) is then collected by biologists and prey species are identified. Data from these site inspections is categorized into age and sex of cougars, date the cougar was present, and species of prey remains.

FIGURE 3

Civic participation–integrated benchmarks.

Step 1: Work with peers and community members to identify and describe a local, regional, or international issue that involves interplay between human and natural systems.

- Identify and describe the natural system, human political and economic systems, and human cultures.

Step 2: Identify the major players and stakeholders (e.g., government agencies, diverse cultural groups, producers, consumers, organizations, and individuals), their perspectives, interests, and resulting positions.

- Determine and describe why the stakeholders hold their given values and beliefs.

Step 3: Explore ways to address the issue by creating and considering alternative solutions related to the issue.

- Consider the feasibility, responsiveness, and likely effectiveness of different action plans.

Step 4: Collaborate in the development of a plan of action in response to the issue.

- Include objectives, timelines, tasks, products, division of labor, and evaluation methods.

Step 5: Prepare a rationale for the plan.

- Consider the impact on the major stakeholders, response of stakeholders, potential consequences (e.g., environmental, human health, public policy, and economic) of implementation.

Step 6: Implement the plan.

- Collect evidence of civic behaviors (e.g., communication with stakeholders, videotapes, surveys/evaluations, photographs, products, and action logs).

Step 7: Evaluate the effectiveness of the plan.

- Evaluate effectiveness based on initial criteria and describe the unintended consequences of implementation.

Information on age and sex of cougar is compiled and correlated with species of prey remains to assess whether different ages and sexes of cougars select different species of prey animals.

In the field investigations, students first pose a research question, then plan and conduct an investigation to answer that question. Students use evidence gathered through their research to support explanations and build models, as well as to pose new questions about the environment (Kelsey and Steel 2001). To answer descriptive and comparative questions, students plot coordinates of cougar locations on computer-generated maps of the study area, and use computer programs to calculate the space each cougar travels annually and during each season (Figure 2).

Student findings

Through their research, students have collected and analyzed data that has contributed to our knowledge of cougar behavior in the Cle Elum area. For example, we have learned that a mature male cougar can defend about 390 km^2—dominant males constantly patrol their territory to protect prey and females from other males. As seen in Figure 2, within this territory, there may be two or three females, each one demanding about 130 km^2 of territory to raise a litter. GPS data has documented young male cougars traveling as far as 250 km through rugged mountain and desert terrain to establish their own territory. In addition, male cougars tend to select for larger prey species, such as elk, while female cougars tend to select for smaller-sized prey, such as deer. Students have presented these findings at the 7th Annual Mountain Lion Conference in Jackson Hole, Wyoming, and to local Big Game Management and Nature Clubs.

Civic participation

The K–12, district- and schoolwide curriculum developed for Project CAT emphasizes civic participation by taking an interdisciplinary and integrative approach to science education. All classes include at least one learning experience that connects to the research goals of Project CAT, allowing every subject area to contribute to the investigation. Geography is taught in part by mapping cougar territories. History is explored through the examination of Native Americans' cultural relationship with the natural world. Economics are addressed in studying the differences between "need and want," as well as in exploring the benefits and drawbacks of government regulations. Through these integrated classes, K–12 students develop research, writing, and presentation skills. Thus, science is embedded in the curriculum as one of many lenses for examining community issues, and the learning environment supports "… students' development toward competent participation in a science-and-technology-infused world, not just as laboratory scientists, but as judges and lawyers, health professionals, environmental consultants, engineers, and citizens" (McGinn and Roth 1999, p. 17).

Consistent with the science and technology (Content Standard E) and science in personal and social perspectives (Content Standard F) standards (NRC 1996, p. 190, 193), PEI developed benchmarks for civic participation to guide curriculum reform efforts and to emphasize that the scientific process involves engagement with stakeholders within the community (Ferguson et al. 2004). Through Project CAT, students identify an issue that involves interplay between human and natural systems, consider the perspectives of multiple stakeholders, create a plan of action, and implement and evaluate the plan (Figure 3, p. 38). Thus, field investigation research informs the development of civic initiatives.

In the community

Based on their analysis of community needs, Project CAT students have created educational programs and are now working on a voters' initiative to prevent wildlife feeding. As part of an outreach effort to educate the community about the ecology of cougars living amongst them, students also created a public presentation program, Cougar Wise, about the consequences of feeding deer and elk. Their educational program demonstrates that these ac-

Project CAT: Background.

Project CAT came about as a result of the tandem efforts of recently retired CER School District superintendent Evelyn Nelson, current superintendent Mark Flatau, Washington Fish and Wildlife biologist Gary Koehler, University of Washington Nature Mapping Program director Karen Dvornich, and Pacific Education Institute (PEI) executive director Margaret Tudor. Working with PEI, a nonprofit organization that facilitates partnerships to help students understand the complex relationships between natural and social environments, this team of individuals created an environmental education curriculum that engages K–12 students in seeing their environment "through the eyes of a cougar." As a result, two useful curriculum models were developed—one for field investigations and one for civic participation.

Additional information about Project CAT can be found in "Cougars, Curriculum, and Community" in the April 2005 issue of *The Science Teacher*, available in the online archives at *www.nsta.org/highschool*.

tivities may attract predators, particularly cougars, which can then result in conflicts with livestock and domestic pets, as well as risks to human safety.

In addition to public presentations, students involved in Project CAT provide education within their own neighborhoods. Spotting a young female cougar crossing through her backyard, one student reacted quickly by videotaping the cougar's progress. Although initially tracking the elk, which were being fed by her neighbors, the cougar instead killed a sheep that had been put out to graze in thick brush. The cougar was later captured by wildlife biologists in a live trap, and both the student and her mother participated in the GPS collaring and release. As a result of the student's efforts, her neighbors came to understand their role in the problem and agreed to stop feeding elk.

During the course of Project CAT, scientists have received mortality signals from cougar GPS collars. On one such occasion, efforts were made to locate and recover the cougar's body. Students working alongside trained wildlife biologists participated in the recovery and determined that the cougar had probably been fatally kicked while stalking an elk. Using a domestic cat skeleton as a model, students reassembled the cougar's skeleton, and now use it in their Cougar Wise presentations.

Science as civic engagement

Project CAT builds scientific and environmental literacy by providing field investigation inquiry experiences, engaging students in civic issues in the community, and introducing them to the stakeholders involved. Youth development researchers highlight the need for young people to contribute to their community and identify civic engagement as an important measure of adult thriving (Benson and Saito 2000).

In addition, the field investigation and civic participation curriculum models that guide Project CAT scaffold student, teacher, and scientist inquiry as they examine together the complex interactions between natural and human systems. The field investigation model helps teachers distinguish among the kinds of investigative questions that frame descriptive, comparative, and correlative studies, and the civic participation benchmarks provide a step-by-step framework for organizing instructional units. When planning and conducting field investigations, students and scientists grapple with the difficulties of working in a natural system and at the same time develop an understanding of its complexities and subsystems. Field investigations help students become systems thinkers, learn the skills of scientific inquiry, and understand that science also happens outside the laboratory or classroom.

Although described in the context of Project CAT, these curriculum models are useful for other community collaborations as well. Possibilities include human/animal and human/plant interactions, water ecology, wetland remediation, air pollution, or any number of other community issues.

Capturing and studying cougars has given students in Cle Elum a story to tell. At their community presentations, public audiences lean forward to listen, ask questions, and share their own cougar stories. When science learning moves beyond the classroom out into the community, it can have a powerful effect on student understanding and appreciation. ■

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On the web

Pacific Education Institute: *www.pacificeducationinstitute.org*
Nature Mapping: *http://depts.washington.edu/natmap/projects/cat*
Project WILD: *www.projectwild.org*