

# Ants Educator Guide

A resource for using QUEST video, audio and blogs in the classroom



## QUEST SUBJECTS

**Life Science**      **Biology**  
                          **Health**  
                          **Environment**

**Earth Science**      **Geology**  
                          **Climate**  
                          **Weather**  
                          **Astronomy**

**Physical Science**      **Physics**  
                          **Chemistry**  
                          **Engineering**

## CA SCIENCE STANDARDS

**Grade 6**  
*Ecology (Life Sciences)*  
 5. (c) Populations of organisms can be categorized by the functions they serve in an ecosystem.

**Grades 9-12**  
*Ecology (Biology/Life Sciences)*  
 6. (a, b, e) Biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats; Changes in an ecosystem result from changes in climate, human activity, introduction of nonnative species, or changes in population size; A vital part of an ecosystem is the stability of its producers and decomposers.

## QUEST MEDIA FOR TEACHING ABOUT ANTS

Read and comment on the blogs for these stories by clicking on the story link and clicking on the blog post link below the video/audio.

Watch "Ants: The Invisible Majority"

<http://www.kqed.org/quest/television/ants-the-invisible-majority2>

- What is so important about ants? Entomologist Brian Fisher, also known as "The Ant Guy," is on a mission to spread the word about the important functions of ants, but he needs our help. He's recruiting everyone to help catalog all of the world's ant species through a comprehensive Internet project he calls AntWeb.

Listen to "Bay Area Ant Invasion" <http://www.kqed.org/quest/radio/bay-area-ant-invasion>

- The invasive Argentine ant species is destroying native ant colonies and threatening native ecosystems throughout California. Listen as scientists discuss how they are hoping to use natural ant pheromones to halt this destructive takeover.

Explore "Interactive Map: Ants of the Bay Area"

<http://www.kqed.org/quest/slideshow/interactive-map-ants-of-the-bay-area>

- There are thousands of different ant species and all of them have important functions in their native ecosystems. Learn about some of the different ant species found in the Bay Area.

## TOPIC BACKGROUND

Often known as the planet's most successful species, ants have called Earth home for over 140 million years. Although they may all look the same to most people, there are about 10,000 known species of ants and many more are thought to exist! Ants live in almost every known environment in the world except in areas covered in permafrost. In fact, the Bay Area alone is home to more than 100 different ant species.

Ants are social insects, as a rule. They live together in large groups called colonies that can contain hundreds or millions of individual ants, depending on the particular species and environment. No matter the species, there are three main kinds of ants in all colonies: queens, female workers and males. A queen is a large female ant whose sole purpose is to lay eggs. Some species of ants have just one queen per colony while others have many. Worker female ants are sterile. These are typically the only ants you will see outside of a colony. In every colony there are different jobs that need to be done, including things like gathering food, taking care of the queen and the eggs and defending the colony. The female worker ants take care of these tasks and more. The workers are divided into castes, or groups, that fulfill specific jobs depending on the species and colony. Worker ants from different castes may sometimes be distinguished by physical characteristics like head size or jaw shape. Male ants have a very short life span. Their only job is to mate with queens. Most male ants have wings. The queen ant has wings, too, but she removes her wings (or has her wings removed by others) once she has mated and is settled into her nest.

### Additional background resources:

- The California Academy of Sciences AntWeb <http://www.antweb.org/>
- Antbase <http://antbase.org/>

## VOCABULARY

### Ecosystem

a community of living organisms and its environment

### Entomology

the scientific study of insects

### Insect

a class of invertebrate animals characterized by a segmented body, which includes a head, thorax and abdomen

### Invasive Species

a widespread, non-indigenous species that has been introduced to an area outside of its native environment

### Native Species

an indigenous species that lives or occurs naturally in a certain environment

### Specimen

an individual that is used to represent a class, genus or whole mass

### Taxonomy

the scientific classification of organisms in an ordered system that indicates natural relationships

### Terrestrial

of or relating to the ground rather than to water or air

## INTRODUCTORY QUESTIONS

- How many different ant species do you think there are? What kinds of ants do you know of?
- Do you think ants are pests? Why or why not?
- What do you think the world would be like without ants?

## FOCUS QUESTIONS

- What are some important functions of ants? What would happen if they weren't a part of the "brown cycle"?
- How does the invasive Argentine ant affect native ant species and the ecosystem at large?
- What makes Argentine ants different from most other ants? Why is it so difficult to stop their invasion?
- What is the Bay Area Ant Survey and why is it important? How can you get involved in this project?

For all media see:

- Segment Summary Student Sheet  
[http://www.kqed.org/quest/downloads/QUEST\\_SegSum\\_StudentSheet.pdf](http://www.kqed.org/quest/downloads/QUEST_SegSum_StudentSheet.pdf)
- Personal Response Student Sheet  
[http://www.kqed.org/quest/downloads/QUEST\\_PersResp\\_StudentSheet.pdf](http://www.kqed.org/quest/downloads/QUEST_PersResp_StudentSheet.pdf)

## LESSON PLANS and RESOURCES from PBS, NPR and MORE

NOTE: Resources from the Teachers' Domain collection require a fast and free registration.

### Tracking a 'Sisterhood' of Traveling Ants NPR

<http://www.npr.org/templates/story/story.php?storyId=127238974>

Named the "Indiana Jones of entomology" by the National Geographic Society, Mark Moffett answers questions and reveals fascinating information about many different species of ants in a June 17, 2010, discussion on **Fresh Air** from WHYY.

### Turning Ant Against Ant: Controlling a Super-Colony NPR

<http://www.npr.org/templates/story/story.php?storyId=6084197>

This September 15, 2006, story from **All Things Considered** discusses how scientists are fighting to control the super-colony of invasive Argentine ants that stretches from the Gulf of Mexico to the Pacific Northwest.

### Amazing Ants Game NOVA

<http://www.pbs.org/wgbh/nova/ants/game.html>

In this interactive learning game, students match eight different species of ants with their unique habits, functions and talents.

### Ancient Farmers of the Amazon Teachers' Domain

<http://www.teachersdomain.org/resource/tdc02.sci.life.evo.leaf/>

This video segment from the **Evolution** episode "Evolutionary Arms Race" shows the important symbiotic relationship between the leafcutter ant and its fungal food source.

### E.O. Wilson: Ants and Ecosystems Teachers' Domain

<http://www.teachersdomain.org/resource/tdc02.sci.life.eco.eowilson/>

American biologist and researcher E.O. Wilson discusses the relationship between ants and fungus in this interview from **Evolution**: "Evolutionary Arms Race."

## VISIT OUR PARTNERS

The Bay Institute  
[www.bay.org](http://www.bay.org)

California Academy of Sciences  
[www.calacademy.org](http://www.calacademy.org)

Chabot Space and Science Center  
[www.chabotspace.org](http://www.chabotspace.org)

East Bay Regional Park District  
[www.ebparks.org](http://www.ebparks.org)

Exploratorium  
[www.exploratorium.edu](http://www.exploratorium.edu)

Girl Scouts of Northern California  
[www.girlscoutsnorcal.org](http://www.girlscoutsnorcal.org)

Golden Gate National Parks Conservancy  
[www.parksconservancy.org](http://www.parksconservancy.org)

The J. David Gladstone Institutes  
[www.gladstone.ucsf.edu](http://www.gladstone.ucsf.edu)

Lawrence Berkeley National Laboratory  
[www.lbl.gov](http://www.lbl.gov)

Lawrence Hall of Science  
[www.lawrencehallofscience.org](http://www.lawrencehallofscience.org)

Monterey Bay Aquarium  
[www.mbayaq.org](http://www.mbayaq.org)

Monterey Bay Aquarium Research Institute  
[www.mbari.org](http://www.mbari.org)

Oakland Zoo  
[www.oaklandzoo.org](http://www.oaklandzoo.org)

The Tech Museum of Innovation  
[www.thetech.org](http://www.thetech.org)

UC Berkeley Natural History Museums  
<http://bnhm.berkeley.edu/>

U.S. Geological Survey  
[www.usgs.gov](http://www.usgs.gov)

## MORE EDUCATIONAL RESOURCES FOR USING QUEST MULTIMEDIA TO ENHANCE 21<sup>st</sup> CENTURY SKILLS IN TEACHING AND LEARNING

### Why Use Multimedia in Science Education?

<http://www.kqed.org/quest/downloads/QUESTWhyMedia.pdf>

- Read about the importance of using multimedia in the 21st century science classroom.

### How to Use Science Media for Teaching and Learning

<http://www.kqed.org/quest/downloads/QUESTMediaTips.pdf>

- A collection of tips, activities and handouts to actively engage students with multimedia.

### Science Multimedia Analysis

<http://www.kqed.org/quest/downloads/QUESTMediaAnalysis.pdf>

- Give your students the tools to recognize the purposes and messages of science multimedia.

### Create Online Science Hikes with Google Maps

[http://www.kqed.org/quest/files/download/52/QUEST\\_ExplorationCreation.pdf](http://www.kqed.org/quest/files/download/52/QUEST_ExplorationCreation.pdf)

- Do you like the science hike Explorations on the QUEST site? Use this place-based educational guide to create similar science-based maps with youth.

## OTHER WAYS TO PARTICIPATE IN QUEST



LOG ON

[www.kqed.org/quest](http://www.kqed.org/quest)



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89.3 FM Sacramento  
Mondays at 6:30am and 8:30am**



WATCH

**KQED Channel 9  
Tuesdays at 7:30pm**

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If you've ever had small, black ants in your kitchen, chances are they're Argentine ants. These invasive insects have spread across California, forming what some scientists say is one of the largest colonies on Earth. They're also threatening native ecosystems. How can we stop them? Well, what if, as Lauren Sommer reports, we could speak their language?

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Most high school biology classes do dissections in a lab, but today the students at Summit Prep High School in Redwood City are finding their specimens in the parking lot.

HERBINSON: Does everyone have a bunch of ants? Does anyone not have ants?

Entomologist Kelly Herbinson is training these seniors to collect ants with a special tool called a "pooter." It works just like a straw, except for a small chamber at the end that traps insects.

HERBINSON: No, no, just be careful not to inhale too much 'cause you might inhale dirt.

The specimens will become part of a scientific study called the Bay Area Ant Survey, run by the California Academy of Sciences.

HERBINSON: We basically had no idea what ants existed in the Bay Area so we just wanted to involve the community in scientific research, so it's a citizen science project.

Herbinson says almost a thousand ants have been sent in to the survey and Cal Academy researchers have ID'd more than 30 different species. But one ant dominates the count: the Argentine ant.

FISHER: So the Argentine ant is basically one colony from Oregon to Mexico. That means that you can't kill the ant colony that's in your house. It's infinite.

Brian Fisher is the Curator of Entomology at the Cal Academy, but most people call him something else.

FISHER: The ant man, or the ant guy.

Fisher love ants. He's discovered more than 1,000 new ant species. He says a major shift is going on here in California. As Argentine ants have spread through the state, they've out-competed and displaced native ants.

FISHER: And this ant has had a huge impact on other insects, too. And other reptiles, like there's a horned lizard that eats ants, but doesn't eat this invasive ant.



And it's actually being endangered now in certain areas because of the Argentine ant.

Scientists believe the ants were accidentally brought to the US in coffee shipments in the 1890s. Now, billions populate the West Coast, living in colonies that have merged to form what's called a "super colony." But that's not normal Argentine ant behavior.

FISHER: Usually, for an ant, the number one enemy is another colony of the same species. But for the Argentine ant, it's all one big happy family.

Fisher says back in Argentina, these ants go to war with each other over territory or resources. That keeps their numbers in check. But since these invasive ants descended from a small group introduced by humans, they're all genetically similar – basically siblings. That means the colonies recognize each other as friends. As a result, they've spread at an alarming rate.

So, what can be done to stop them?

TSUTSUI: In this one tub we probably have 100,000 ants, maybe.

Neil Tsutsui is an associate professor of ecology at UC Berkeley. He keeps a relatively small group of Argentine ants in a Tupperware container in his lab.

TSUTSUI: So you can see, if you watch an ant closely, when they walk around and encounter another ant, they pause for just a moment. And that's when they're sniffing each other with their antenna.

Ants use chemical cues, or pheromones, to send out alarms, let other ants know where food is, and to tell if another ant is a friend or foe.

TSUTSUI: For a particular colony, they have this suite of odors that characterizes the colony. And if we can figure that out, we're interested in determining ways to maybe manipulate that behavior and trick Argentine ants into thinking that they belong to different colonies.

In order to trick the ants, Tsutsui needed to crack the chemical code that helps Argentine ants tell each other apart. So, he went in search of colonies that descend from a different group that is a natural enemy of the super colony. He then isolated the chemicals on those ants, searching for the special blend that makes up their enemy uniform.

TSUTSUI: So we have some ants here that have been placed into a vial that has a film of hydrocarbons around the outside.



That film is the man-made version of the enemy ant pheromone. Tsutsui takes several ants out of his colony and shakes them up in the vial. He then taps them back into the nest, where moments ago they were happy workers.

SOMMER: They're all gathering around her.

TSUTSUI: Yeah, they know something's wrong.

The treated ants begin cleaning themselves furiously, but it's too late.

BOTH: Oh my gosh.

TSUTSUI: So that was a pretty intense lunge and grab.

As soon as a worker bites onto one of the ants, other workers join in the attack.

TSUTSUI: There are two ants that each have one leg and a third ant that has an antenna. Yeah, these two ants are doomed.

This may seem like a mean trick, but Tsutsui says it could become a targeted way to control Argentine ants without using insecticides.

TSUTSUI: If we could alter the Argentine ants' behavior in way that they control themselves, then that would hopefully selectively remove Argentine ants but leave the rest of the organisms unharmed.

Tsutsui says there's still more research to do before we can buy spray bottles of enemy ant pheromone at the hardware store. But it may be one of the only ways to remove a fierce invader, without harming the ecosystems we're trying to protect.

For QUEST, I'm Lauren Sommer, KQED Radio News.