

SCIENTISTS IN THE FIELD

WHERE SCIENCE
MEETS ADVENTURE

DISCUSSION AND ACTIVITY GUIDE

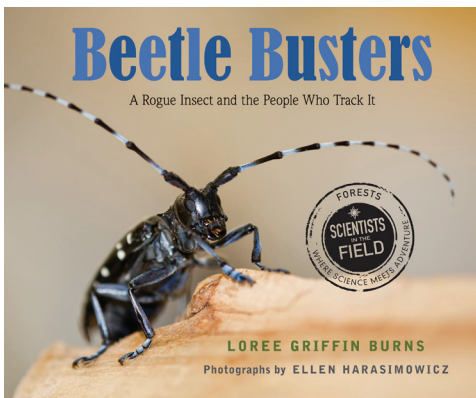
Beetle Busters

by Loree Griffin Burns Photographs by Ellen Harasimowicz



About the Series

Beetle Busters: A Rogue Insect and the People Who Track It is part of the award-winning Scientists in the Field series, which began in 1999. This distinguished and innovative series examines the work of real-life scientists doing actual research. Young readers discover what it is like to be a working scientist, investigate an intriguing research project in action, and gain a wealth of knowledge about fascinating scientific topics. Outstanding writing and stellar photography are features of every book in the series. Reading levels vary, but the books will interest a wide range of readers.



About the Book

Despite the odds against it, larvae of the destructive Asian longhorned beetle arrived in America, perhaps inside a wooden pallet or crate. In 1996, a sharp-eyed New Yorker noticed that something was damaging his maple trees. Officials put two and two together and the first Asian longhorned beetle eradication project came into being. The author Loree Griffin Burns describes the life cycle of this spectacular invader, the efforts to study and contain it, and the controversial methods the eradication teams are using.

About the Author

Dr. Loree Griffin Burns holds a Ph.D. in biochemistry and has found a way to combine her many interests, exchanging her life as a professional scientist for one as a writer of children's science books. *Tracking Trash*, published in 2007, was her first book and was a Boston Globe–Horn Book Honor Book for Nonfiction. Since then she has written four more outstanding books. Her lively blog provides information of her life, fascinating research trips, and a list of suggested books and websites.

About the Photographer

Ellen Harasimowicz began work as a photographer and photojournalist in 2004 and has worked for the *Boston Globe* and *Worcester Telegram & Gazette*. Her work has appeared in the *Washington Post* and *Scientific American*, among other places. In 2008, she teamed up Loree Griffin Burns for *The Hive Detectives*, and since then they have worked on this and two other books together.

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Pre-Reading Activity

During a forest fire, firefighters will often set fires in an attempt to fight fires. Think about this and ask yourself why. What do the firefighters hope to accomplish, and what could go wrong with starting a fire in the path of an existing fire? Is there any relationship between what firefighters are doing and cutting down trees to fight beetle infestations?

Read the story of the American chestnut tree: www.scientificamerican.com/article/chestnut-forest-a-new-generation-of-american-chestnut-trees-may-redefine-americas-forests. What can we learn from the loss of these trees that may help us fare better with the Asian longhorned beetle?

Research the steps taken to control invasive species, such as the introduction of the cane toad in Australia (circa 1935) or the mongoose in Hawaii. These studies are examples of biological control methods. Other methods include chemical control and mechanical control. Have students define each of these three methods, including a listing of the pros and cons for each one. Are any of these methods more effective with certain species than others?

Make a list of invasive species in your area. How did they come to be in your area and what steps are being taken to remove them?

Discussion Questions

Where on the spectrum of priorities should we place invasive species? Isn't the spread of various species simply the natural "survival of the fittest" evolutionary law? Haven't we seen animals and plants move into areas throughout our history?

What makes the Asian longhorned beetle (ALB) so dangerous that we are willing to cut down, and send them through a chipper without even being sure the tree is infected? Is there any way we can use technology to target infected trees more accurately so that we do not have to sacrifice healthy trees?

Why is this beetle such a problem in the United States and not a problem in its own natural range?

Are humans capable of becoming an invasive species? Are humans already an invasive species?

Should the United States spend more money on regulating imports from other countries to insure that pests like ALB are not accidentally introduced into our country? Should certain sensitive areas, such as national parks or state forests, be more proactive about preventing people from introducing invasive species?

How would you react if all the trees in your town were cut down and chipped or burned?

Applying and Extending Our Knowledge

On page 56 we read: *"Believe it or not, successful ALB eradication will depend heavily on people like you. (Yes, you!) Every North American ALB infestation—New York, Chicago, Jersey City, Toronto, Worcester, Boston, Bethel—was discovered by a private citizen, an observant person with no training in entomology who saw something unusual (a massive black and white beetle with blue feet and striped antennae) and did something about it (called an ALB hotline, or something like it, to report what he'd found). If we are to keep Asian longhorned beetles out of our trees, we need to keep our eyes on those trees, watching the insects we see there and alerting officials to anything that looks remotely suspicious."*

At your school or in your neighborhood find a tree that students can spend some time inspecting. Before visiting the trees, make a class prediction chart for the organisms students expect to find in the trees.

Assign students a specific tree to monitor with a field journal. Make sure to map the site so the students are always observing the exact same tree. For the next month (or longer), have students record their observations as regularly as time permits (ideally, on a daily basis). Students should sketch the trunk, paying special attention to any unusual holes, scratches, scars, wounds, coloration, or other unexpected details.

Print checklists of the organisms from your earlier observation to distribute to students. Have students list any organisms found on their tree (adding any new ones, as required). Discuss reasons for not seeing some animals and regularly seeing others.

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Which are always found, usually found, regularly found, sometimes found, rarely found, and never found in a student's specific habitat? Take a daily picture from the exact same location with a digital camera. Make sure to date each picture.

These activities may also be used by students with trees of their own choosing (and assigned as homework or extra credit).

Compare the class predictions before starting with what the class observes monthly (and at the end of the time period). What new predictions and hypotheses do the students have?

What other organisms are pests to the trees in your neighborhood? Keep a list of these organisms and research the various plans for controlling these pests.

Common Core Connections

CCSS.ELA-Literacy.RST.6-8.3

Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

CCSS.ELA-Literacy.W.7.7

Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.

CCSS.ELA-Literacy.RH.6-8.7

Integrate visual information (e.g., in charts, graphs, photographs, videos, or maps) with other information in print and digital texts.

When dealing with invasive species, scientists typically employ three types of control responses: biological, chemical, or mechanical. We increase the number of organisms that kill the pest, we use pesticides or other chemicals to kill or reduce reproduction rates, or we do things like build fences to keep out unwanted organisms.

First begin with a class brainstorming activity to get a sense of how we envision the definition of "invasive." After brainstorming, look up the definition of "invasive species" from the United States Department of Agriculture, U.S. Fish and Wildlife Service, and/or National Geographic (or similar organizations). Now look for information specific to your area about invasive species. Check with your state

department of natural resources (or similar state governmental agency).

Divide the class into teams to deal with one of the invasive species on your list of local ones. Come up with a plan that describes the species biologically, traces its journey from its native area, maps its new territories, documents its history in your neighborhood, and applies a control method (or a combination of control methods) with a prediction of results over time, with a written justification for why the group expects these results. Be sure to revisit the pre-reading exploration of the mongoose and cane toad. Students may also wish to review our history with chemicals such as DDT.

Debate the basic premise of invasive species. Have a debate or conduct a mock trial that explains why the ALB is fine in parts of China but such a horrible pest in the United States that we will cut down and chip trees without even being certain that the tree actually has pests. Be sure to answer why the beetle that lays eggs in trees and eats the trees does not cause ecological devastation in Asia but does here. What does our habitat lack Asia's doesn't? Also include the fact that many of our supposed natural resources today are actually imported, possibly invasive, organisms.

Write a play from the perspective of the Asian longhorned beetle. Keep in mind this quote from page 15: *"The story of the Asian longhorned beetle in North America begins in northern China, where the insect was once a harmless and natural part of the environment."* Write a description of invasive species specifically for young elementary students.

If we made a dartboard representing all of the animal life on the planet, with the size of each dartboard section corresponding to the number of different families found in nature, beetles would have a very large section. If we threw darts at this board, it would surprise no one if we hit a beetle. They are hard to miss. Beetles are divided into several major groups.

Review with students basic scientific taxonomy, especially the Animalia kingdom—specifically insects.

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Chart and explain where the ALB belongs in the range of 350,000+ beetle species. Divide the beetles into their major groups. Do a visual (using Prezi or Keynote or Powerpoint or other similar) presentation showing the range of beetles and showing specifically where ALB fits.

Prepare a poster showing the ALB. On this poster include genus and species, traditional range, current range, diet, life span, place on the food chain, life cycle information, and other noteworthy details.

Common Core Connections

CCSS.ELA-Literacy.RST.6-8.4

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.

CCSS.ELA-Literacy.W.7.7

Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.

CCSS.ELA-Literacy.W.7.1

Write arguments to support claims with clear reasons and relevant evidence.

CCSS.ELA-Literacy.W.7.1.b

Support claim(s) with logical reasoning and relevant evidence, using accurate, credible sources and demonstrating an understanding of the topic or text.

CCSS.ELA-Literacy.SL.7.1.c

Pose questions that elicit elaboration and respond to others' questions and comments with relevant observations and ideas that bring the discussion back on topic as needed.

CCSS.ELA-Literacy.W.7.3

Write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and well-structured event sequences.

CCSS.ELA-Literacy.RST.6-8.7

Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

On page 44 we read, "...the forest contained fourteen different tree species, several of which are known to be ALB hosts. These included red maple, sugar maple, sweet birch, white ash, and various elms." Chapter 1 begins with the fact that scientists spend much of their time looking at trees.

If your area allows, collect leaves from as many of these trees as possible. If not (and for trees not available) draw pictures of the leaves and create an online folder of leaf pictures from these trees. Do the same with the bark from these trees. Prepare labels or annotations pointing to the leaf and bark characteristics that distinguish one tree from another.

Have students define the word *dendrochronology*. Collect various online photographs of tree rings. Have students, independently write a year-by-year analysis of the tree's health by inspecting the tree rings. It may help to highlight three or more tree rings for students to explain (and then have students pick an additional ring or rings to discuss).

Common Core Connections

CCSS.ELA-Literacy.W.7.7

Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.

CCSS.ELA-Literacy.RH.6-8.7

Integrate visual information (e.g., in charts, graphs, photographs, videos, or maps) with other information in print and digital texts.

CCSS.ELA-Literacy.RST.6-8.4

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.

On page 22 we read, "Mike began to see live beetles in this part of the city, and they were frightening. 'The beetles were enormous,' he recalls. 'They were the largest Asian longhorned beetles I had ever seen; I never saw beetles that big in New York or Chicago or in China.'"

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The book shows an ALB infestation map on page 19. Compare the types of trees found in these five areas. The quote above comes from the Massachusetts site. Predict which of the habitat variations in these five sites (abundance of certain types of trees, climate, weather, geography, significant landforms, etc.) is most likely responsible for producing significantly larger ALBs in Massachusetts. Do this as a group activity and have the class synthesize the various reports into a working class hypothesis. Once this is done, have students design ways that students or scientists might test the hypothesis.

The ALB is described as a “handsome” beetle. The super beetles in Massachusetts, with their black and white patterned antennae and pretty blue feet, may have some doubting their destructive capacity. Keeping this in mind and also looking at the picture of the tin tree tag on page 18, write a Kipling-esque *Just So* story explaining the “handsome” features of the ALB. Make sure your story explains how this good-looking critter not only gets its features, including its strong jaws, but also became a pest. Read “The Cat That Walks By Himself” for ideas.

The ALB and the invasive purple loosestrife plant (*Lythrum salicaria*) are described by many as beautiful. Speculate on whether or not this attitude helps the organisms thrive, does not help the organism thrive, or is irrelevant as a consideration.

Common Core Connections

CCSS.ELA-Literacy.SL.7.1

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others’ ideas and expressing their own clearly.

CCSS.ELA-Literacy.W.7.1

Write arguments to support claims with clear reasons and relevant evidence.

CCSS.ELA-Literacy.W.7.1.b

Support claim(s) with logical reasoning and relevant evidence, using accurate, credible sources and demonstrating an understanding of the topic or text.

CCSS.ELA-Literacy.SL.7.1.c

Pose questions that elicit elaboration and respond to others’ questions and comments with relevant observations and ideas that bring the discussion back on topic as needed.

CCSS.ELA-Literacy.W.7.3

Write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and well-structured event sequences.

On page 31 we read, “Among the hazards awaiting surveyors in the woods are poison ivy (and related rash-producing plants), yellow jackets (and related stinging insects), ticks (year round), glass and metal shards (surprisingly common and easy to accidentally kneel on), neighborhood dogs (who mostly don’t like strangers traipsing through their woods), and, in New England at least, weather conditions ranging from frigid to frying.” Later we also read of tree-blindness from staring at trees all day long.

Rate your own ability to work in less than ideal conditions to study an insect pest, which may force you to chop down and chip all the trees in the area. Are you one of those *Let me climb the trees, investigate core samples, search for frass, and do it all people?* Or are you an *If I see a large beetle with blue feet and black and white antennae, I will call person?* What factors would have to be present to change your mind?

Reflect on how important it is for our government to track the ALB and work on removing it from our forests.

Common Core Connections

CCSS.ELA-Literacy.W.7.2.b

Develop the topic with relevant facts, definitions, concrete details, quotations, or other information and examples.

CCSS.ELA-Literacy.W.7.1.b

Support claim(s) with logical reasoning and relevant evidence, using accurate, credible sources and demonstrating an understanding of the topic or text.

CCSS.ELA-Literacy.W.7.2.d

Use precise language and domain-specific vocabulary to inform about or explain the topic.

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Further Reading

Jenkins, Steve. *The Beetle Book*. Houghton Mifflin Harcourt, 2012.

National Wildlife Federation. *Field Guide to Trees of North America*. Sterling, 2008.

Smithsonian Nature Guide: Trees. Dorling Kindersley, 2012.

Both of these guides are extensive but student – friendly tree identification books.

Other Websites to Explore

Loree Griffins Burns

loreeburns.com

Loree Griffins Burns’s official author site, with additional information about her books.

Asian Longhorned Beetle

civr.ucr.edu/asian_beetle.html

Information on the Asian longhorned beetle from the Center for Invasive Species Research at the University of California–Riverside.

asianlonghornedbeetle.com/get-involved/educate

More information and ways to get involved for educators and students.

National Invasive Species Information Center

www.invasivespeciesinfo.gov/index.shtml

Gateway to information on invasive species from the USDA.

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Ed Spicer, Curriculum Consultant, and Lynn Rutan, retired middle school librarian, now reviewer and blogger at *Bookends: the Booklist Youth Blog*