

Drive-by Extinction – Bay Checkerspot Butterfly Educator Guide

A resource for using QUEST audio in the classroom

Listen to it online <http://www.kqed.org/quest/radio/view/221> 5:45 minutes



QUEST SUBJECTS

- Life Science**
- Biology**
- Health
- Environment**
- Earth Science**
- Geology
- Weather
- Astronomy
- Physical Science**
- Physics
- Chemistry
- Engineering

CA SCIENCE STANDARDS

- Grade 2**
- Life Sciences*
- 2. Plants and animals have predictable cycles. (b,e)
- Grade 3**
- Life Sciences*
- 3. Adaptations in physical structure or behavior may improve an organism's chance for survival. (c,d,e)
- Grade 4**
- Life Science*
- 2. All organisms need energy and matter to live and grow. (a)
- 3. Living organisms depend on one another and on their environment for survival. (b,c)
- Grade 6**
- Ecology*
- 5. Organisms in ecosystems exchange energy and nutrients among themselves and with the environment. (d,e)
- Grade 9-12**
- Ecology*
- 6. Stability in an ecosystem is a balance between competing effects. (b,e)

PROGRAM NOTES

Edgewood County Park and Natural Preserve was once home to a vibrant population of bay checkerspot butterflies, but now it's difficult to see even one. The butterfly is now categorized as a federally threatened species whose decline has been called "drive-by extinction." Exhaust fumes from nearby I-280 have contributed to destroying the butterfly's food source, a serpentine grass. Learn what biologists are doing to prevent the bay checkerspot from going extinct.

In this segment you'll find...

- 🔍 what the bay checkerspot butterfly eats and where it lives.
- 🔍 how cars play a role in the decline of the bay checkerspot butterfly.
- 🔍 what the San Mateo County Department of Parks is doing to increase the butterfly population.



TOPIC BACKGROUND

The bay checkerspot butterfly (*Euphydryas editha bayensis*) is a member of the brush-footed butterfly family (Nymphalidae). Historically, the butterfly was found all around the San Francisco Bay Area, from San Francisco to Contra Costa County and south to Hollister. In September 1987, the bay checkerspot was designated as a federally threatened species under the Endangered Species Act. It is one of 13 federally listed butterflies found in California. Currently the bay checkerspot occurs only in San Francisco, San Mateo and Santa Clara County.

The bay checkerspot life cycle starts when the larvae hatch from the eggs about 10 days after they are laid. The larvae shed their skin three times as they grow during the next two or more weeks. Larvae will then enter a period of dormancy for the summer months, hidden under rocks or in cracks in the soil. During the next rainy season, the dwarf plantain (*Plantago erecta*) starts to grow. It is the primary food source for the bay checkerspot's larval (caterpillar) stage. The larvae resume their development and continue eating. Once the larvae are fully grown, they enter the pupa stage and form a chrysalis. Adults emerge as butterflies in early spring. During the next four to six weeks they feed on nectar, mate, and lay eggs, typically in March and April. Females lay up to five egg masses of up to 250 eggs each, which they deposit near the base of the plantain, and the cycle starts over.

The habitat for the bay checkerspot butterfly consists exclusively of shallow, serpentine-derived soils. Serpentine soils are high in magnesium and heavy metals and low in basic nutrients (nitrogen, phosphorus and calcium), because they're formed from rocks from the ocean floor. Soils that lack basic minerals make life challenging for the plants that grow on them, and these plants have to use special techniques to adapt to their difficult life. Plants that have adapted to these soils, such as the dwarf plantain, are often specialized to live only on these soils. This makes them vulnerable to an invasion by another plant. Often these plants will not grow anywhere else if they get pushed out of their habitat.

Media Enhance Education

Video and audio can be powerful tools for meaningful learning. It all depends on you, the educator. The key to using media effectively is preparation. Make the most of learning opportunities by encouraging students to become active viewers and listeners. Pick and choose from the suggested questions and activities to offer an engaging media experience.

Questioning

Oftentimes, teachers and students become frustrated during a media segment when students can't find the answers to a long list of questions. Provide a limited number of questions or topics for students. This focuses their attention during a media segment, helps to keep them engaged and generally results in higher quality answers. QUEST Ed. has provided a number of options for focus questions, ranging from fact based to opinions to "big picture" ideas.

PRE LISTENING

- What is the life cycle of a butterfly?
- What do butterflies and caterpillars eat?
- Where is the bay checkerspot butterfly found?
- What is an invasive species? What is a native species?
- How do invasive species affect native species?
- What role do butterflies play in their community/habitat?

LISTENING FOCUS

NOTE: You may choose to watch the television segment twice with your students: once to elicit emotional responses and get an overview of the topic and again to focus on facts and draw out opinions.

- Record any facts you find interesting while you watch.
- What is the invasive weed that is choking out the butterfly's native host plant?
- What is the native host plant of the bay checkerspot?
- How did car pollution cause the decline of the bay checkerspot?
- What is Dr. Stuart Weiss doing to increase the number of bay checkerspots at Edgewood Park?
- What is the park doing to control the spread of Italian ryegrass?
- What can be done to prevent the continued decline of the butterfly?

POST LISTENING Links to activities mentioned can be found on the following page.

- **Review** students' answers to the Viewing Focus Questions.
- **Grow** butterflies in your classroom and study their life stages. Draw the life cycle of the butterfly that you observe.
- **Explore** the role of butterflies as pollinators. Follow the procedures in the **Butterfly Activity Guide** and discover the relationship between butterflies and plants.
- **Write** letters to help support the recovery work of the bay checkerspot. Letters can be written to decision makers to make sure recovery programs continue to be funded and receive all needed resources.
- **Help** eliminate invasive species in your community. Volunteer with organizations that pull invasive weeds and conduct restoration projects.

“When we try to pick out anything by itself, we find it hitched to everything else in the universe.” – John Muir

LESSON PLANS / ACTIVITIES

Butterfly and Nature Gift Store

<http://www.butterfly-gifts.com/live-butterfly-kits.html>

- Find resources for buying butterfly kits for your classroom and raising butterflies.

Butterfly Activity Guide – The Butterfly Conservation Initiative

http://www.butterflyrecovery.org/education/docs/BFCI_ActivityGuide.pdf

- Discover the life cycle of a butterfly, explore butterflies as pollinators or learn about butterfly migration. This guide gives you three butterfly activities to conduct with your students.



The Bay Institute

<http://www.bay.org/main.htm>

- The mission of this nonprofit organization is to restore the ecosystem of the San Francisco Bay Area and its surrounding watershed. It conducts restoration projects and inspires students to be stewards of their communities.

ARTICLES / READING

Bay Checkerspot Butterfly Natural History U.S. Fish & Wildlife Service

http://www.fws.gov/sacramento/es/animal_spp_acct/bay_check.htm

- This Web site provides natural history information, federal status, distribution information as well as other references.

Friends of Edgewood Natural Preserve

<http://www.friendsofedgeswood.org/>

- This nonprofit organization seeks to preserve and protect the Edgewood Natural Preserve. This Web site contains photos, stories and newsletter articles about the preserve.

Bay Checkerspot Butterfly – The Butterfly Conservation Initiative

http://www.butterflyrecovery.org/species_profiles/bay_checkerspot/

- Here you'll find natural history information on the bay checkerspot, including conservation needs.

Serpentine Splendor: The Native Colors of Edgewood Park Bay Nature

http://www.baynature.com/2004apriljune/ott_edgewood.html






- This article about the serpentine soils in Edgewood Park has photos and information on the bay checkerspot butterfly.

Look for the



indicating resources from QUEST partner organizations

QUEST QUAD

FIELD NOTES 	FIELD TRIP 
<p>Go outside and ...</p> <ul style="list-style-type: none"> ⦿ Discover the wonders of serpentine soils <ul style="list-style-type: none"> • Observe the differences between serpentine soils and other types of soils. • What do the plants look like? What does the environment as a whole look like? ⦿ Observe butterflies in the wild <ul style="list-style-type: none"> • Go to an area where there are many flowers in bloom and watch the butterflies. • Keep a journal of what the butterflies do, how many flowers they visit and how the butterflies benefit the plants. 	<p>Visit ...</p> <ul style="list-style-type: none"> ⦿ Edgewood Park and Natural Preserve <ul style="list-style-type: none"> • Take a trip here and try to find bay checkerspot butterflies. Conduct a teacher-led tour or arrange a tour through the park. http://www.sanmateocountyparks.org ⦿ Redwood Regional Park <ul style="list-style-type: none"> • Check out serpentine grasslands at the Skyline Serpentine Prairie http://www.cnga.org/action/visiting.php?place=06_serpentine 
FIELD RESEARCH 	FIELD TEST 
<p>Find out more about...</p> <ul style="list-style-type: none"> ⦿ Another federally threatened butterfly <ul style="list-style-type: none"> • Are there other threatened or endangered butterflies in California? If so, pick one and find out more information about its natural history, distribution and status. http://ecos.fws.gov/tess_public/SpeciesReport.do?groups=1&listingType=L&mapstatus=1 ⦿ California invasive plants <ul style="list-style-type: none"> • Why should we be concerned with invasive plants? Which ones are abundant in the San Francisco Bay Area and what effects do they have on their habitats? 	<p>Experiment with...</p> <ul style="list-style-type: none"> ⦿ Creating a butterfly and native plant garden <ul style="list-style-type: none"> • Follow the guidelines below on planting a garden especially to attract butterflies. http://www.monarchwatch.org/garden/creating.htm ⦿ Reducing car pollution at home and at school <ul style="list-style-type: none"> • Carpool to school with friends. • Ride your bike whenever possible. • Share the story of the bay checkerspot with others to educate them about the effects of car exhaust on native plants and animals.

VISIT OUR PARTNERS

The Bay Institute

www.bay.org

California Academy of Sciences

www.calacademy.org

Chabot Space and Science Center

www.chabotspace.org

East Bay Regional Park District

www.ebparks.org

Exploratorium

www.exploratorium.edu

Girl Scouts of Northern California

www.girlscoutsnorcal.org

Golden Gate National Parks Conservancy

www.parksconservancy.org

The J. David Gladstone Institutes

www.gladstone.ucsf.edu

Lawrence Berkeley National Laboratory

www.lbl.gov

Lawrence Hall of Science

www.lawrencehallofscience.org

Monterey Bay Aquarium

www.mbayaq.org

Monterey Bay Aquarium Research Institute

www.mbari.org

Oakland Zoo

www.oaklandzoo.org

The Tech Museum of Innovation

www.thetech.org

UC Berkeley Natural History Museums

<http://bnhm.berkeley.edu/>

U.S. Geological Survey

www.usgs.gov

MORE EDUCATIONAL RESOURCES FOR USING QUEST MULTIMEDIA TO ENHANCE 21ST 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

- 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



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



WATCH

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



A sure sign of spring in San Mateo County was once the emergence of the Bay Checkerspot butterfly, until one spring it wasn't there. The butterfly became extinct in this park after a wave of freeway construction. Now after a six-year absence, the Checkerspot, known for its orange, red and white markings, has returned to Edgewood Park and Natural Preserve. But this isn't just a story about one butterfly's resilience.

WEISS: I brought 142 caterpillars we collected this morning down in south San Jose on Coyote Ridge.

Stu Weiss is a field biologist. The U.S. Fish and Wildlife Service granted him permission to collect caterpillars from Coyote Ridge where they thrive on a native plant that's their primary food source. But here at Edgewood Park near Redwood City, that plant gets choked out by an invasive weed, called Italian Rye Grass.

WEISS: The reason this is able to grow so profusely on this particular patch of serpentine soil is because of the exhaust from the 113,000 vehicles a day going by on highway 280.

Those vehicles, according to Weiss, are spewing exhaust through smog control devices known as catalytic converters. In the 1970's, in an effort to control nitrogen oxide, a pollutant that causes that brown haze in the summer, the California Air Resources Board required the automobile industry do something.

WEISS: The catalytic converters were too efficient in reducing the nitrogen oxide and instead chemically reduced it all the way to ammonia. Ammonia is a much more potent fertilizer. Plants, especially things like the Italian rye grass just suck it right out of the air.

And it grows like mad, choking off a small native plant, the dwarf plantain.

WEISS: For me and the Checkerspot butterfly it is the most important plant in the world because it's the only thing they eat.

Weiss calls the series of events that lead to the Checkerspot's demise "drive by extinction." To restore the butterfly he'll eventually bring one thousand caterpillars to Edgewood. Dressed in khaki with a safari hat, Weiss reaches down to open a small cooler.

WEISS: It's a little ice chest and this one is Trader Joes hummus dip.

Not really, it's really a threatened caterpillar.

WEISS: Right.

Weiss walks through the grasslands looking for the small silver flowered plantain and gently drops the bushy black caterpillars next to their food of choice.



WEISS: What I do is find a spot like that, take a caterpillar, and just drop it down there.

In a few weeks, Weiss will be back to check on the caterpillar's progress.

WEISS: I'll be looking for Bay Checkerspot butterflies flying around here for the first time since 2001.

Three weeks later, these rolling hills are popping with wildflowers, fields of purple, blue and yellow blooms. Weiss has returned for a butterfly count. Every other day Weiss or a trained volunteer is out here walking the 35-acre plot looking for Checkerspots. He found the first one a week ago

We proceed gingerly through the grass as the biologist peers over each shoulder.

WEISS: Still zero. You can't be too eager to see them. Time to start the watch again.

By the time we reach the fifth monitoring point, we haven't found one butterfly. And then, off to our right...

WEISS: There's the Checkerspot...phew, phew! Got to have faith.

Is that the same one?

WEISS: No, that's a different one, I think. A two-for! Woo hoo!

We count two more before the day is done. But the real test will be next year:

WEISS: The key is going to be next February when we come out and count caterpillars because that will determine what population response we had this year, whether the population goes up or goes down, and that's sort of the world cup.

So, how will the butterfly survive as long as ammonia exhaust still drifts over from the nearby 280?

That's where mowing comes in. Every few years mowers will chop the tips off the Italian Rye Grass before it reseeds.

WEISS: We get the best results when you bring in a crew of weed whackers and string cutters and you just really take it down by hand, but that is pretty expensive per acre.



Weiss is lobbying the California Air Resources Board, hoping the agency will begin studying the ammonia coming from catalytic converters. Though air officials are skeptical of the ammonia link, they plan to send an observer to Edgewood.

WEISS: 10 percent of the cars put out 50 percent of the ammonia so it's a matter of models, makes, years and maintenance.

Even if the ammonia problem is solved, the tiny butterfly is not out of the woods. Global warming could mean changes in rainfall and temperature, further reducing the butterfly's food. For now, Weiss is optimistic, remembering the lesson of naturalist John Muir, who once said, "When we try to pick out anything by itself, we find it hitched to everything else in the Universe." In other words, even tiny creatures reveal the health of our landscapes.

For KQED radio news, I'm Andrea Kissack.