

Create Models to Teach Others about an Invasive Animal Near School

3rd Grade Guam STEM Design Challenge

Anchor Question: How can we create models of an invasive species and the traps being used to control them so we can teach others what they can do to help the native species and stay safe?

Overview

Guam Connection

Invasive non-native plants and animals can cause severe changes to native plant and animal populations, impact environments and affect people's lives. Throughout history, people have intentionally and unintentionally moved plant and animal species to new environments. Some of these species have proved beneficial, but others invade natural habitats causing environmental, and sometimes economic harm. A few examples of invasive animal species include the brown tree snake, African land snail, coconut rhinoceros beetle, and the recently arrived greater banded hornet.

Engineering Design Challenge

Build an accurate model of the invasive animal, the native plant or animal it harms, and the trap or strategy now being used on Guam to catch or control the invasive animal. Consider choosing the invasive species that is affecting your school or village, that your students are most concerned about, or that they fear. Use these models to creatively and accurately tell the Guam story of the invasive species and what people need to do to be safe and to help protect our native island species.

NGSS Performance Expectation

3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

STEM Concepts (NGSS Disciplinary Core Ideas)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience. When the environment changes...some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.

LS4.D: Biodiversity and Humans. Populations live in a variety of habitats and change in those habitats affects the organisms living there.

LS4.C: Adaptation. For any environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.

Time: Estimated Number of Classes

3-5 classes (45-minute class)

Materials for the Design Challenge

Paper, markers, plastic cups (colors), ball of string, plastic plates (several sizes and colors), craft sticks, masking tape, drinking straws, scissors, Q-tips, cotton balls, food items to act as lures (example: vanilla, coffee, soda), assorted building materials (wire, screen, cardboard, twist ties, foil, tape, glue)

The Q-U-E-S-T Experience



Why Care?

What is the problem, anchor question, and design challenge? How is this relevant and interesting to us and where we live?

Question

Begin by asking QUESTIONS about the problem and ways to solve it. Figure out what you already know, and brainstorm what you could do.

Uncover

Learn the science ideas needed to understand the problem and design a project to solve the problem.

Explore

Apply what you've learned in Uncover to EXPLORE the problem in your community and consider project ideas to solve the problem.

Solve

Use the engineering design process to design and do a project that helps SOLVE the problem.

Teach

Share your project with others to help others understand the problem and how your project helped solve it.



Why Care?

What is the problem, anchor question, and design challenge? How is this relevant and interesting to us and where we live?

Introduce the Quest

1. **Post and read the anchor question:** How can we use models of an invasive species and the technology being used to trap or control it to teach our school and families how to help reduce the harm they cause and to help them stay safe?
2. **Read, describe, and post the design challenge:** Design accurate model props for telling the story of the invasive species on Guam. Build an accurate model of the animal, the native plant or animal it harms, and the trap or strategy now being used on Guam to catch or control the invasive animal. Consider choosing the invasive species that is affecting your school or village, that your students are most concerned about, or that they fear. Examples include the brown tree snake, coconut rhinoceros beetle, the greater banded hornet, and the giant African land snail. Use these models to creatively and accurately tell the Guam story of the invasive species and what people need to do to be safe and to help protect our native island species. Explain why the trap or other procedure is effective. How have experts designed (engineered) the trap using the science they have learned about the invasive animal?

3. **Introduce invasive species:** Everywhere you go on Guam you can find reminders of animals living here that are harming our native animals. The native plant populations are declining. Example: Coconut trees attacked by rhinoceros beetles. Small rodent and bird populations have also been reduced because of the brown tree snakes.)
 - a. Show one or both of these videos and discuss: [What is an invasive species?](#) (NOAA). [Invasive species on Guam](#), (2020, National Pesticide Safety Education).
4. **Share and talk about the Driving Question for why we should care:** Why should I care about invasive species and helping others learn about them? What invasive species do we see around school and our village, and how is it affecting us and our native plants and animals? How might it affect my island, my community, my family, and/or me? (Invasive non-native plants and animals can cause severe changes to local environments. This alters the normal balance between the plants and animals.)

Guam-STEM Design Notebook for students ([FOLDER with pdf and editable pages](#))

Write or draw your “why I care” and why others on Guam care.



Question

Begin by asking **QUESTIONS** about the problem and ways to solve it. Figure out what you already know, and brainstorm what you could do.

Ask Questions

1. **Create a KND Chart (Know, Need to know, Do)** with the three driving questions below. Save the questions and responses to look at during the QUEST; writing them on chart paper, butcher paper, in student design notebooks, or use a digital organization chart, like Jamboard. KND Questions:
 - a. What do we **KNOW** already about invasive animal species?
 - b. What do we **NEED TO KNOW** to study their impact on the environment and their possible danger to humans?
 - c. What could we **DO** to learn about their role disrupting the native plants and animals? What are some ideas of what we could **DO** to support the findings of scientists and help educate other students and people in our communities? What other questions do we need to answer
2. **Gather responses from students.** Have students think and write responses: 1. First, silently and individually, 2. Then, in small groups, 3. And finally, with the full class. The end result is a class KND chart to refer to, add to, and reorganize throughout the QUEST. Students could sort the responses that are similar. This information will help guide the UNCOVER and EXPLORE.

Guam-STEM Design Notebook for students ([FOLDER with pdf and editable pages](#))

Write KND lists. Organize the questions (Need to Know) from class. Record the categories, or themes, of the questions and ones you are most interested in.



Uncover

Learn the science ideas needed to understand the problem and design a project to solve the problem.

Uncover Key Ideas

1. **Share the Driving Question:** What animals are non-native to Guam and how did they get here?
 - a. [Brown tree snake](#), (Invasive Species Information). Several videos here.
 - b. [Coconut rhinoceros beetle](#) (Invasive Species Information). Several videos here.
 - c. [Greater banded hornet](#), New invasive wasp found on Guam, PNC (video embedded). [Video news report on wasp](#) (KUAM News)
 - d. [African Land Snail](#), (Guampedia)
2. **Share the Driving Question:** Choose the animal most impacting the school and village. What problems is one of these non-native invasive animals causing for our school or village? How is it affecting our native plants and animals, the environment, and the people?
 - a. Activity: [Brown tree snake: Survivor!](#) Food webs and the introduction of foreign species.
 - b. Go to “Additional Resources” at the bottom of the page for a list of resources on Guam invasive species.
3. **Share the Driving Question:** How do the invasive animal’s adaptations or life cycle help it survive and thrive on Guam by harming our native plants and animals?
 - a. Go to “Additional Resources” at the bottom of the page for a list of resources on Guam invasive species.
 - b. Resource needs will vary depending on the animals you focus on and the concepts you need to understand to make an effective trap.
4. **Share the Driving Question:** What are ways people have tried to protect our native plants and animals from these non-native animals?
 - a. [Ask experts or knowledgeable community members](#) to talk with students: Invite one or more people to class who are studying these species and working to control their populations.
 - b. [Show past and current traps](#) in photos, videos, or actual traps being used to capture one or more invasive species.

Guam-STEM Design Notebook for students ([FOLDER with pdf and editable pages](#))

Write the driving question and summarize what you did and learned. (blank page)

Students will understand these NGSS Disciplinary Core Ideas:

LS4.D: Biodiversity and Humans. Populations live in a variety of habitats and change in those habitats affects the organisms living there.

LS2.C: Ecosystem Dynamics, Functioning, and Resilience. When the environment changes...some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.

LS1.B: Growth and Development of Organisms. Reproduction is essential to the continued existence of every species.

LS4.C: Adaptation. For any environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.



Explore

Apply what you've learned in Uncover to EXPLORE the problem in your community and consider project ideas to solve the problem.

Apply Your Learning

1. **Share the Driving Question with students:** How can we apply what we learned in UNCOVER to understand the problem of invasive animals in our community and to come up with project ideas to share what we know with school and community members so they can understand the harm they are causing to our environments?
2. **Revisit the KND lists** you wrote at the beginning of your Quest. Add and edit them to include new understandings and experiences from UNCOVER.
 - a. **KNOW** - What have you confirmed as accurate? Correct any inaccurate information.
 - b. **NEED to know** - Mark any questions that you have answered, and ones you still need and want to answer. Add new questions.
 - c. **DO** - Add any new project ideas you could do to help solve the problem.
3. Return to the anchor question: How can we use models of an invasive species and the technology being used to trap or control it to teach our school and families how to help reduce the harm they cause and to stay safe?
 - a. **Introduce:** Everywhere you go on Guam you can find reminders of animals living here that are harming our native animals. The native plant populations are declining. (Example: Coconut trees attacked by rhinoceros beetles). Small rodents and bird populations have also been reduced. (Example: brown tree snakes)
 - b. **Ask:** What invasive species do we see around school and our village, and how is it affecting us and our native plants and animals?
 - c. **Website:** [Invasive species on Guam](#)
 - d. **Show photos** of Guam invasive species and traps to catch them. Ask questions about the photos like:
 - i. Who has noticed these things hanging on fences or trees? [show photos of traps]
 - ii. What happened to these coconut trees? [photo of rhino beetle signs]
 - iii. What questions do you have about these images?
 - e. **Share stories** of seeing the animal on school grounds or in the village. If possible to see signs of the animal, walk around school grounds to notice those signs.
4. Read and talk about the design challenge: Design accurate model props for telling the story of the invasive species on Guam. Build an accurate model of the animal, the native plant or animal it harms, and the trap or strategy now being used on Guam to catch or control the invasive animal. Consider choosing the invasive species that is affecting your school or village, that your students are most concerned about, or that they fear. Examples include the brown tree snake, coconut rhinoceros beetle, the greater banded hornet, and the giant African land snail. Use these models to creatively and accurately tell the Guam story of the invasive species and what people need to do to be safe and to help



protect our native island species. Explain why the trap or other procedure is effective. How have experts designed (engineered) the trap using the science they have learned about the invasive animal?

- a. [Build an Insect Trap](#) (Includes a list of materials needed)
- b. [Animal Adaptations: Create the animal](#)

Guam-STEM Design Notebook for students ([FOLDER with pdf and editable pages](#))

- Design Challenge Map- Complete as much as you can. Then add to and edit it throughout SOLVE.
- Design Requirements and Limitations (criteria and constraints)



Solve

Use the engineering design process to design and do a project that helps SOLVE the problem.

Do your design challenge: Decide on the story you want to tell and show with models.

1. The story can include:

- a. What each of us at school and in our families need to know and understand about this invasive species to be a part of the solution
- b. How and when the animal got here
- c. What scientists know: Its adaptations and life cycle that allows it to thrive here and harm our native animals or plants
- d. What engineers are designing: How the traps or other strategies are working to control the animal. How well the traps/strategies are working. Why the animal is still a problem even with these traps and strategies.
- e. Other ideas we have for what engineers could do to help protect our native plants and animals from this invasive species

2. Create an accurate model using the steps of the [Engineering design process](#) (Poster).

- a. Decide what you want you want your model to do and to look like.
- b. Get the materials you need to build your model.
- c. Build your model.
- d. Test your model to see if it works to demonstrate how an animal feeds on plants and animals. How well did it work and what could you do to make it work better? Students can revise their model based on their test and their answer to the questions about their model.
- e. What did not work well? Why do you think it did not work well?
- f. How could you improve your model?
- g. Students modify their model or make a new model. Then test it and compare how well it worked compared to their first model. Encourage them to make different models and be able to explain why one model works better than another.

3. Use the model props to create an accurate story (3D demonstrating by telling or 2D written picture book) to share with others. The story must include the claim of how the current strategy on island is the best so far in efforts to reduce the harm the invasive species is causing to our environment.

Guam-STEM Design Notebook for students ([FOLDER with pdf and editable pages](#))

- Edit and complete the Design Challenge Map.
- Edit and complete the Design Requirements and Limitations (criteria and constraints)
- Action Plan: List steps to complete the project, and who will do what.
- Team Self-Review: Review your project design to make sure it is focused on the design challenge, anchor question, and Guam.
- Gathering Feedback from Others: Get input from others to help strengthen your project.
- Claim-Evidence-Reasoning (CER): Give evidence for the most effective project design.



Teach

Share your project with others to help others understand the problem and how your project helped solve it.

Share & Reflect on What You Learned

1. **Return to the anchor question:** How can we use models of an invasive species and the technology being used to trap or control it to teach our school and families how to help reduce the harm they cause and to stay safe?
2. **Do this:** Students creatively share their project and how it helped solve the problem. Teach other students, our relatives or friends about this invasive species by using our prop models to tell their Guam story or reading our book about their Guam story.
 - a. Who's your audience? Who will benefit from hearing about and seeing your project?
 - b. How will you share this information?
 - c. What do you want them to know and understand about the problem, how you collected data on iNaturalists, your project and its impact?
 - d. When and where will you share?
3. **Student reflection:** After teaching others, students can complete a reflection about their Design Challenge. Here is one option: 4-3-2-1: Looking back, planning forward. Respond to:
 - a. FOUR of the most important things I learned doing this design challenge.
 - b. THREE of the most important things I learned about myself doing this design challenge.
 - c. TWO things I will do differently on my next problem-solving experience.
 - d. ONE thing I now want to learn more about.

Guam-STEM Design Notebook for students ([FOLDER with pdf and editable pages](#))

- TEACH. Make a plan for sharing your project with others.
- Looking back, planning forward. Reflect on what you did and what you might do next time.

Additional Resources on Invasive Species on Guam

Brown tree snake

- [Brown tree snake](#), (Invasive Species Information). Several videos here.
- Brown Treesnake, <https://youtu.be/SfwffcCeeqA> and <https://youtu.be/-NTCzIR6awk>
- Article: [Invasive Brown Treesnake Present on Cocos Island, Agencies Working to Prevent Further Spread](#) (2020)

Coconut rhinoceros beetle

- [Coconut rhinoceros beetle](#) (Invasive Species Information). Several videos here.
- [The rhinoceros beetle](#) (UOG)
- [A Pacific Battle to Eradicate the Rhinoceros Beetle](#) (Oct 2017)

Greater banded hornet

- [Greater banded hornet](#), New invasive wasp found on Guam, PNC (video embedded).
- [Video news report on wasp.](#)
- [Great banded hornet fact sheet](#)

African land snail

- [Land snails of the Mariana Islands](#) (Guampedia)
- [Invasive species on Guam](#) (UOG)
- [Giant African land snail](#) (Invasive Species Information)
- Video: [Why giant snails are a problem in Florida](#) (CNN)



Administered by the Guam Department of Education (GDOE) - Federal Programs Division (FPD) - State Educational Agency (SEA) and funded by the Consolidated Grant to Outlying Areas.