



Batsies Learning Guide

Grades 6-12

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This Learning Guide supports the film, *Batsies*, from the H-E-B Presents: Our Texas, Our Future film series. Watch the 15-minute film for free:

<https://ourtexasourfuture.com/stories/bats/>

About This Resource

As our planet’s only flying mammal, bats are incredible animals, yet they are often misunderstood. Bats across the globe play important roles in ecosystems, including seed dispersal, pollination, and insect control.

Bats have lived on Earth for more than 50 million years. There are over 1,400 different species of bats worldwide. Bats live on every continent except Antarctica. More than 30 different species of bats live in Texas and the state is home to Bracken Cave Preserve, the world’s largest bat colony!

Despite this historical success, bat populations face multiple challenges today such as the impacts of climate change, habitat loss, invasive species, a disease called white-nose syndrome, and wind turbines.

The *Batsies* video and the accompanying learning resources guide you to explore bats through the eyes of two female wildlife biologists as they research new ways to protect bat populations.

Learning Objectives

Students will...

1. DESCRIBE the roles bats play in ecosystems and CREATE a food web and an energy pyramid to diagram an insectivorous bat's ecological roles.
2. LOCATE Bracken Cave on a map.
3. LIST multiple threats to bat populations.
4. EXPLAIN how wind turbines are an important tool in combating climate change yet are negatively impacting bats worldwide.
5. SUMMARIZE what humans are currently doing to prevent bat deaths at wind turbines, EVALUATE the costs and benefits of this work, and GENERATE additional ideas about what else can be done to prevent bat deaths.
6. IDENTIFY the advantages and limitations of a model designed to test bats' responses to ultrasonic deterrents.
7. EXPLORE the work of two STEM professionals (wildlife biologists).

Teaching Tips

This Learning Guide is written with grades 6-12 in mind. You can implement the full guide or select the learning objectives, standards, and discussion questions that will work best for your students.

Texas Essential Knowledge & Skills (TEKS) Science

Science TEKS, Adopted 2027	Science TEKS, Adopted 2020/21 <i>implementation begins fall 2024</i>
<ul style="list-style-type: none"> • 6-8(3)(C) identify advantages and limitations of models such as size, scale, properties, and materials • 7(5)(B) diagram the flow of energy through living systems, including food chains, food webs, and energy pyramids • 7(10)(B) describe how biodiversity contributes to the sustainability of an ecosystem • BIO(3)(E) evaluate models according to their limitations in representing biological objects or events • BIO(12)(C) analyze the flow of matter and energy through trophic levels using various models, including food chains, food webs, and ecological pyramids • BIO(12)(E) describe how environmental change can impact ecosystem stability • ENV(3)(E) describe the connection between environmental science and future careers • ENV(9)(E) evaluate the effect of human activities, including habitat restoration projects, species preservation efforts, nature conservancy groups, hunting, fishing, ecotourism, all-terrain vehicles, and small personal watercraft, on the environment • ENV(9)(F) evaluate cost-benefit trade-offs of commercial activities such as municipal development, farming, deforestation, over-harvesting, and mining 	<ul style="list-style-type: none"> • 6-8(2)(A) identify advantages and limitations of models such as size, scale, properties, and materials • 6-8(4)(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field to investigate STEM careers • 6-8(5)(B) identify and investigate cause-and-effect relationships to explain scientific phenomena or analyze problems • 7(12)(A) diagram the flow of energy within trophic levels and describe how the available energy decreases in successive trophic levels in energy pyramids • 8(12)(A) explain how disruptions such as population changes, natural disasters, and human intervention impact the transfer of energy in food webs in ecosystems • 8(12)(C) describe how biodiversity contributes to the stability and sustainability of an ecosystem and the health of the organisms within the ecosystem • BIO&ENV(2)(A) identify advantages and limitations of models such as their size, scale, properties, and materials • BIO&ENV(4)(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, mathematics (STEM) field in order to investigate STEM careers • BIO(13)(D) explain how environmental change, including change due to human activity, affects biodiversity and analyze how changes in biodiversity impact ecosystem stability • ENV(11)(A) evaluate the negative effects of human activities on the environment, including overhunting, overfishing, ecotourism, all-terrain vehicles, and personal watercraft • ENV(11)(B) evaluate the positive effects of human activities on the environment, including habitat restoration projects, species preservation efforts, nature conservancy groups, game and wildlife management, and ecotourism • ENV(12)(A) evaluate cost-benefit trade-offs of commercial activities such as municipal development, food production, deforestation, over-harvesting, mining, and use of renewable and non-renewable energy sources

Texas Essential Knowledge & Skills (TEKS)

Social Studies

Social Studies TEKS, Adopted 2018	Social Studies TEKS, Adopted 2022 <i>implementation begins fall 2024</i>
<ul style="list-style-type: none"> • 7(8)(B) locate and compare places of importance in Texas in terms of physical and human characteristics such as major cities, waterways, natural and historic landmarks, political and cultural regions, and local points of interest • 7(9)(A) identify ways in which Texans have adapted to and modified the environment and explain the positive and negative consequences of the modifications • 7(9)(B) explain ways in which geographic factors such as the Galveston Hurricane of 1900, the Dust Bowl, limited water resources, and alternative energy sources have affected the political, economic, and social development of Texas • 7(19)(C) analyze the effects of various scientific discoveries and technological innovations on the development of Texas such as advancements in the agricultural, energy, medical, computer, and aerospace industries • 7(20)(A) differentiate between, locate, and use valid primary and secondary sources such as media and news services, biographies, interviews, and artifacts to acquire information about Texas 	<ul style="list-style-type: none"> • 7(8)(B) locate and compare places of importance in Texas in terms of physical and human characteristics such as major cities, waterways, natural and historic landmarks, political and cultural regions, and local points of interest • 7(9)(A) identify ways in which Texans have adapted to and modified the environment and explain the positive and negative consequences of the modifications • 7(9)(B) explain ways in which geographic factors such as the Galveston Hurricane of 1900, the Dust Bowl, limited water resources, and alternative energy sources have affected the political, economic, and social development of Texas • 7(19)(C) analyze the effects of various scientific discoveries and technological innovations on the development of Texas such as advancements in the agricultural, energy, medical, computer, and aerospace industries • 7(20)(A) differentiate between, locate, and use valid primary and secondary sources such as media and news services, biographies, interviews, and artifacts to acquire information about Texas

Next Generation Science Standards (NGSS)

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

The performance expectation listed above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

<p>Science & Engineering Practices Engaging in Argument from Evidence Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).</p> <ul style="list-style-type: none">• Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
<p>Disciplinary Core Ideas LS2.C: Ecosystem Dynamics, Functioning, and Resilience</p> <ul style="list-style-type: none">• Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.
<p>Crosscutting Concepts Stability and Change</p> <ul style="list-style-type: none">• Small changes in one part of a system might cause large changes in another part.

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

The performance expectation listed above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

<p>Science & Engineering Practices Constructing Explanations and Designing Solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.</p> <ul style="list-style-type: none">• Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
<p>Disciplinary Core Ideas LS2.C: Ecosystem Dynamics, Functioning, and Resilience</p> <ul style="list-style-type: none">• Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. <p>LS4.D: Biodiversity and Humans</p> <ul style="list-style-type: none">• Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). (secondary)• Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (secondary) (Note: This Disciplinary Core Idea is also addressed by HS-LS4-6.) <p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none">• When evaluating solutions it is important to take into account a range of constraints including cost, safety, reliability and aesthetics and to consider social, cultural and environmental impacts. (secondary)
<p>Crosscutting Concepts Stability and Change</p> <ul style="list-style-type: none">• Much of science deals with constructing explanations of how things change and how they remain stable.

Batsies

English Resources

Academic Vocabulary

From: lead4ward Academic Vocab <https://lead4ward.com/resources/>

Grade 6 Science	Grade 7 Science	Grade 8 Science
<ul style="list-style-type: none"> ecosystem organism population species nonrenewable resources (coal, oil, natural gas) renewable resources (wind) 	<ul style="list-style-type: none"> climate drought ecosystem ecoregion energy pyramid environment environmental change food chain food web flow of energy habitat migrate organism species sustainability trophic level 	<ul style="list-style-type: none"> climate ecosystem environment environmental change flow of energy food chain food web habitat organism population species trophic level

Biology	Grade 7 Social Studies
<ul style="list-style-type: none"> ecosystem ecological pyramid energy pyramid environment environmental change flow of energy food chain food web habitat impact order organism population predator predation prey species trophic level 	<ul style="list-style-type: none"> agricultural industry climate cotton industry consequences economic impact environment fossil fuels human factors interdependence modify modified the environment negative consequences positive consequences

Background Reading

Bats

Bats are the only mammals that can fly. They are classified in the order Chiroptera, the second largest order after rodents. More than 1,400 different species of bats live across our planet. Bats inhabit every continent apart from Antarctica.

Bats play an important role in ecosystems:

- Bats disperse seeds for, pollinate, and protect a variety of crops including bananas, guava, durians, cashews, dates, figs, cacao, sugar, corn, agave, and cotton (BCI, 2024).
- In the tropics, fruit-eating bats disperse seeds that help restore cleared or damaged rainforests (BCI, 2024).
- Bat poop (guano) is a natural fertilizer (BCI, 2024).
- Bats are a food source (prey) for predators such as birds of prey, weasels, minks, raccoons, and snakes.



A bird of prey hunts bats in Texas.
Photo: Fin & Fur Films Productions

Bats are often misunderstood. Some people are afraid of bats. In some cultures, bats are associated with darkness, evil, and death. There are many common myths about bats such as:

- Some people think all bats drink blood. This is not true. Of the 1,400+ species of bats on Earth, only three feed on blood. These vampire bats live in the New World tropics (i.e., South America, Central America, and Mexico). They are small and typically feed on the blood of livestock. They use their sharp, pointed front teeth to make small cuts in the skin of an animal and then lap up the blood with their tongue (BCI, 2024).
- Sometimes people think bats are blind. This is not true. All bats can see. Some bat species have night vision. Other bat species use echolocation to navigate and hunt at night (BCI, 2024).
- A common misconception is bats will fly into your hair. This is not true. Bats are not attracted to human hair. Some bats can catch small flying insects mid-flight and can definitely avoid a human head! (Virginia Department of Wildlife Resources, 2024).



Bracken Cave in Texas
Photo: Fin & Fur Films Productions

Bracken Cave

Part of this video was filmed at Bracken Cave, which is located in Comal County, northwest of San Antonio, Texas. This area of Texas is in the Edwards Plateau ecoregion, part of the Great Plains physical region of Texas.

Bracken Cave is home to over 15 million Mexican free-tailed bats during the summer months. This population is a maternity colony, consisting of females and their pups,

and is one of the largest concentrations of mammals on Earth. The emergence of this bat population, as they come out of the cave each evening to hunt insects, is a stunning sight (BCI, 2024).

Threats to Bats

Bats have been on Earth for more than 50 million years. However, bat populations face multiple challenges today such as the impacts of climate change, habitat loss, invasive species, a disease called white-nose syndrome, and wind turbines.

The major threats that climate change poses to bat populations include:

- mortality from more frequent extreme weather events,
- mortality and a decrease in reproductive success in areas that experience increased aridity and droughts, and
- changes in the seasonal timing of food resources (e.g., flowering plants or seasonal insect abundance) could negatively impact bats that migrate (BCI, 2024).

The *Batsies* video highlights how wind turbines are impacting bats. While wind turbines help reduce our reliance on fossil fuels by utilizing a renewable energy source—wind—dead bats are often found under wind turbines worldwide. It is not yet known what is causing these bats to die around wind turbines. The scientists in the *Batsies* film are working to understand this issue and are researching devices designed to deter bats from flying too close to the blades of turbines.



Wind Turbines
Photo: Fin & Fur Films Productions

STEM Careers

The scientists featured in this video each have a PhD. This stands for Doctor of Philosophy. A PhD is a research degree and is one of the highest levels of education you can achieve in an area of study. The Ph in PhD does not refer to the subject of philosophy, rather it is connected to the original Greek meaning of philosophy which roughly means “lover of wisdom.”

- [Dr. Sarah Fritts](#) - Associate Professor, Texas State University

Dr. Fritts is a Certified Wildlife Biologist. In her current role as Associate Professor at Texas State University, she teaches biology classes and conducts research. Her research examines how wildlife populations respond to changes in the environment due to weather and land use.

Dr. Fritts’s education includes the following degrees:

- Bachelor of Science (BS) in Wildlife Biology & Management from the University of Georgia
- Master of Science (MS) in Fish & Wildlife Conservation from the University of Illinois Urbana-Champaign
- Doctor of Philosophy (PhD) in Fisheries, Wildlife, and Conservation Biology from North Carolina State University

- [Dr. Sara Weaver](#) - Principal and Natural Resources Director at Bowman



Dr. Sara Weaver
Photo: Fin & Fur Films Productions

Dr. Weaver currently works at Bowman Consulting, a firm that supports real estate, energy, and environmental projects across the United States. She leads a team of specialists that provides clients with information on permitting, threatened and endangered species, and wildlife management.

She previously worked as a Lecturer and Adjunct Professor at Texas A&M University-San Antonio.

Dr. Weaver's PhD research focused on understanding and reducing bat fatalities at wind turbines. Her current research focuses on integrating technology into wildlife impact reduction strategies in the renewable energies sector.

Dr. Weaver's education includes the following degrees:

- Bachelor of Science (BS) in Biology from Texas State University
- Master of Science (MS) in Wildlife Ecology from Texas State University
- Doctor of Philosophy (PhD) in Aquatic Resources & Integrative Biology from Texas State University

Take Action

Learning about bats and then teaching others what you learn is a great way to support bats and help others understand the vital roles bats play in ecosystems.

Bat Conservation International (BCI) is a globally recognized conservation organization dedicated to ending bat extinctions.

- [Visit BCI's website](#) to learn more about bats.
- Experience bats through [bat sounds, a live camera, videos, and bat events](#).
- Learn more about [BCI's work here](#).



Mexican Free-Tailed Bats
Photo: Fin & Fur Films Productions

Discussion Questions

Bats

1. Have you ever seen a bat in real life? Reflect on the experience. Where were you? What did you see? What was your reaction to seeing a bat?
2. Do you agree or disagree with the following statement? “Bats are misunderstood.” Explain.
3. The *Batsies* video shows the emergence of over 15 million Mexican free-tailed bats (a specific bat species) from Bracken Cave which is located outside of San Antonio, Texas. Find Bracken Cave on a map. How long would it take you to get there from where you are today?
4. During the summer months, visitors to Bracken Cave can watch the bat population emerge each evening as they leave the cave to hunt for insects. As the bats emerge, they fly out in a formation that looks like a tornado, a tornado of bats! This is sometimes called a “batnado.” Would you like to visit Bracken Cave? Why or why not?
5. What are some roles bats play in our ecosystem? List at least two.
6. Create a food web that shows how energy is transferred in an ecosystem. Include at least one bat that eats insects (an insectivore). For Grade 7: To further investigate the available energy in this ecosystem, also create an energy pyramid with the same organisms used in the food web.
7. What are some threats to bat populations in Texas? List at least three.

The Impacts of Environmental Changes

8. List at least one positive environmental impact of wind turbines.
9. List at least one negative environmental impact of wind turbines.
10. What are humans doing to prevent bats from colliding with wind turbines?
11. If bats continue to be killed by wind turbines in Texas, how might that impact the ecosystems they are a part of? List at least two impacts.
12. What are some costs associated with researching how to prevent bat deaths at wind turbines? What are some benefits of this work?
13. Ultrasonic deterrents are one tool currently used to prevent bats from flying too close to wind turbines. Can you think of another strategy that could be used to prevent bats from being hit by wind turbines? Describe your idea.

The Flight Cage: Advantages & Limitations of This Model

14. The *Batsies* video shows Dr. Sarah Fritts and her team putting bats into a flight cage. What is this cage designed to test?
15. What are two advantages of using this model?
16. What are two limitations of using this model?

STEM Careers

17. What are some challenges Dr. Sara Weaver and Dr. Sarah Fritts have faced throughout their careers?
18. What are some things Dr. Sara Weaver and Dr. Sarah Fritts like about their work?
19. What aspects of Dr. Sara Weaver’s and Dr. Sarah Fritts’s work would you enjoy? Are there any parts of their job that you think you would dislike? Explain.

Name _____

Batsies

Discussion Question Responses

Directions: After watching the film, *Batsies*, answer the discussion questions. For each question, first write the number of the question and then write your answer.

Answer Key - Discussion Questions

Bats

1. Students will describe and reflect on any experiences they've had seeing a bat in real life.
2. Students will explain whether or not they agree with the statement, "Bats are misunderstood."
3. Students will identify how long it would take them to travel to Bracken Cave from their home or their school.
4. Students will share if they'd like to visit Bracken Cave or not.
5. Examples of roles bats play in the ecosystem include:
 - Every night insectivorous bats hunt insects. This helps control the insect population and helps farmers control agricultural pests.
 - Bats are a food source (prey) for predators such as birds of prey, weasels, minks, raccoons, and snakes.
 - Bats disperse seeds for, pollinate, and protect a variety of crops.
 - In the tropics, fruit-eating bats disperse seeds that help restore cleared or damaged rainforests.
 - Bat poop (guano) is a natural fertilizer.
6. Students will sketch a food web that shows energy transfer from the Sun → producers → insects → bats → predators of bats such as birds of prey, weasels, minks, raccoons, and snakes. Students in Grade 7 will also create an energy pyramid with the same organisms used in the food web.
7. Threats to bat populations in Texas include:
 - habitat loss
 - a disease called white-nose syndrome
 - the impacts of climate change
 - wind turbines

The Impacts of Environmental Changes

8. A positive environmental impact of wind turbines is that they help reduce our reliance on fossil fuels by utilizing a renewable energy source, wind.
9. A negative environmental impact of wind turbines is they are causing bats to die. Carcasses of dead bats are regularly found under wind turbines across the globe.
10. One strategy used to prevent bat deaths at wind turbines is to install ultrasonic deterrents on the turbines to keep bats from flying too close. These deterrents emit high-frequency noises and have been shown to reduce bat fatalities when installed on wind turbines. Scientists are still working to understand how bats perceive these sounds. One hypothesis is that bats don't like the noise. Some scientists think that for bats, this noise is similar to how a human would feel standing next to a speaker at a heavy metal concert. The bats don't like the sound, so they move away from it.
11. If bats continue to be killed by wind turbines in Texas, possible ecosystem impacts include:
 - There will not be as many bats to help control the insect population, both in our communities and over farmland. An increase in agricultural pests could damage crops or cause farmers to spend more money on and use more pesticides which could negatively impact the environment.

- Bats are a food source for many animals including birds of prey, weasels, minks, raccoons, and snakes so these populations could suffer if bat populations are reduced.
12. Costs associated with researching how to prevent bat deaths at wind turbines include:
- Research takes time and money. The longer it takes to find a solution, the more bats will die.
- Benefits associated with researching how to prevent bat deaths at wind turbines include:
- Figuring out how to prevent bat deaths at wind turbines will help protect bat populations worldwide, populations that are already experiencing environmental stressors in other areas such as habitat loss, disease, and climate change.
13. Answers will vary as students describe another strategy that could be used to prevent bat deaths at wind turbines.

The Flight Cage: Advantages & Limitations of This Model

14. The flight cage is designed to test how bats respond to ultrasonic deterrents. In the flight cage, bats are exposed to different ultrasonic deterrents and different configurations of the deterrents. Dr. Fritts and her team are looking for the best way to use deterrents on wind turbines to prevent bats from getting too close and getting hit by the blades.
15. Advantages of this model include:
- The researchers can observe how live bats respond to different deterrents.
 - Researchers can observe species and gender-specific responses to ultrasonic deterrents in the flight cage to help determine what works best for each group. Scientists are not able to make these detailed observations at wind turbines.
 - The bats can be returned to their habitats once the tests are complete.
16. Limitations of this model include:
- The experience may be stressful for bats.
 - The deterrents are being tested away from wind turbines. When the deterrents are placed on wind turbines bats may respond differently.

STEM Careers

17. Challenges Dr. Sara Weaver and Dr. Sarah Fritts have faced throughout their careers include:
- Dr. Sarah Fritts said that she's faced a lot of pressure to present her work and gain respect in the field.
 - Dr. Sara Weaver said when she started working in wildlife, she was usually one of the few women in the room. Now the field is more than 50% female.
 - When Dr. Sara Weaver went back to school to earn her PhD, she had two young children and was working full-time. It was a lot of work.
18. Some things Dr. Sara Weaver and Dr. Sarah Fritts like about their work include:
- They think bats are spectacular animals and are passionate about ensuring bats have the environment they need to survive and thrive.

- Dr. Sarah Fritts says there is so much more still to learn about bats. They are under-researched.
 - They are engaged in their work of figuring out how and why wind turbines are killing bats.
 - They get to collaborate with each other. They have a friendship that inspires them to be better at what they do.
19. Answers will vary as students describe the aspects of Dr. Sara Weaver's and Dr. Sarah Fritts's work they think they would enjoy and parts they think they would dislike.

Batsies

Spanish Resources

Acerca de este recurso

Como el único mamífero volador de nuestro planeta, el murciélago es un animal increíble, pero está malentendido. Los murciélagos de todo el mundo desempeñan un importante papel en los ecosistemas, incluso la dispersión de semillas, la polinización, y el control de insectos.

Los murciélagos han vivido en la Tierra más de 50 millones de años. Hay más de 1,400 diferentes especies de murciélagos en el mundo. Los murciélagos viven en cada continente excepto la Antártida. Hay más de 30 diferentes especies de murciélagos viviendo en Texas, y en este estado se encuentra la Reserva de la Cueva Bracken, la colonia de murciélagos más grande del mundo!

A pesar de este éxito histórico, las poblaciones de murciélagos se enfrentan a muchas amenazas hoy, incluyendo los efectos del cambio climático, la pérdida de su hábitat, especies invasoras, una enfermedad llamada el síndrome de la nariz blanca, y las turbinas eólicas.

El video llamado *Murcielaguitos* y los recursos educativos que lo acompañan te guiarán a explorar los murciélagos a través de los ojos de dos biólogas de fauna salvaje mientras ellas estudian nuevas maneras de proteger las poblaciones de murciélagos.



Murciélagos mexicanos de cola libre
Foto: "Fin & Fur Films Productions"

Vocabulario académico

De: lead4ward Academic Vocab <https://lead4ward.com/resources/>

6º Grado Ciencias	7º Grado Ciencias	8º Grado Ciencias
<ul style="list-style-type: none"> • ecosistema • organismo • población • especie • recursos no renovables (carbón, petróleo, gas natural) • recursos renovables (viento) 	<ul style="list-style-type: none"> • clima • sequía • ecosistema • ecorregión • pirámide de energía • medio ambiente • cambio medioambiental • cadena alimenticia • red alimenticia • flujo de energía • hábitat • migrar • organismo • especie • sostenibilidad • nivel trófico 	<ul style="list-style-type: none"> • clima • ecosistema • medio ambiente • cambio medioambiental • flujo de energía • cadena alimenticia • red alimenticia • hábitat • organismo • población • especie • nivel trófico

Biología	7º Grado Estudios Sociales
<ul style="list-style-type: none"> • ecosistema • pirámide ecológica • pirámide de energía • medio ambiente • cambio medioambiental • flujo de energía • cadena alimenticia • red alimenticia • hábitat • impacto • orden • organismo • población • depredador • depredación • presa • especie • nivel trófico 	<ul style="list-style-type: none"> • industria agrícola • clima • industria algodonera • consecuencias • impacto económico • medio ambiente • combustibles fósiles • factores humanos • interdependencia • modificar • modificó el medio ambiente • consecuencias negativas • consecuencias positivas

Lectura de fondo

Murciélagos

Los murciélagos son los únicos mamíferos que pueden volar. Son clasificados en el orden Chiroptera, el segundo más grande después de roedores. Hay más de 1,400 diferentes especies de murciélagos en todo nuestro planeta. Los murciélagos habitan todos los continentes excepto la Antártida.

Los murciélagos desempeñan un importante papel en los ecosistemas:

- Los murciélagos dispersan semillas, polinizan, y protegen una variedad de cultivos incluso los plátanos, guayabas, durianes, anacardos, dátiles, higos, cacao, azúcar, maíz, agave, y algodón (BCI, 2024).
- En zonas tropicales, los murciélagos frugívoros dispersan semillas que ayudan a restaurar los bosques tropicales talados o dañados (BCI, 2024).
- Caca de murciélago, conocida como “guano”, es un fertilizante natural valioso (BCI, 2024).
- Los murciélagos son una fuente de alimento (presa) para los depredadores como aves rapaces, comadrejas, visones, mapaches y serpientes.



Un ave de rapiña caza murciélagos en Texas.
Foto: “Fin & Fur Films Productions”

Los murciélagos a menudo están malentendidos. Mucha gente les tiene miedo. En algunas culturas, los murciélagos están asociados con la oscuridad, la malvada, y la muerte. Hay muchos mitos comunes sobre los murciélagos incluyendo lo siguiente:

- Alguna gente piensa que todos los murciélagos toman sangre. Esto no es verdadero. De las 1,400+ especies de murciélagos en la Tierra, solamente tres de ellas se alimentan de sangre. Estos murciélagos vampiros viven en Los trópicos del Nuevo Mundo (incluso en Sudamérica, Centroamérica, y México). Son pequeños y usualmente se alimentan de la sangre de ganado. Usan sus dientes afilados y puntiagudas en frente para hacer pequeños cortes en la piel del animal y luego lamiendo la sangre con su lengua (BCI, 2024).
- A veces la gente cree que los murciélagos son ciegos. Esto no es verdadero. Todos los murciélagos pueden ver. Algunas especies de murciélagos tienen visión nocturna. Otras especies de murciélagos usan la ecolocalización para navegar y cazar de noche (BCI, 2024).
- Una idea errónea muy común es creer que los murciélagos vuelen hacia tu pelo. Esto no es verdadero. Los murciélagos no se sienten atraídos por el cabello humano. Algunos murciélagos pueden atrapar pequeños insectos voladores en pleno vuelo, iy definitivamente pueden evitar una cabeza humana! (Virginia Department of Wildlife Resources, 2024).



La cueva Bracken en Texas
Foto: "Fin & Fur Films Productions"

La cueva Bracken

Parte de este video se filmó en la cueva Bracken situada en el condado Comal, al noroeste de San Antonio, Texas. Esta área de Texas se encuentra en la ecorregión llamada Meseta Edwards, parte de la región física de Texas llamada las Grandes Llanuras.

La cueva Bracken es el hogar de más de 15 millones de murciélagos mexicanos de cola libre durante los meses de verano. Esta

población es una colonia de maternidad formada por hembras y sus crías, y es una de las mayores concentraciones de mamíferos en la Tierra. El surgimiento de los millones de murciélagos, cuando salen de la cueva cada anochecer para cazar insectos, es una vista impresionante (BCI, 2024).

Amenazas para los murciélagos

Los murciélagos han existido en la Tierra desde hace más de 50 millones de años. Sin embargo, las poblaciones de murciélagos se enfrentan a muchas amenazas en la actualidad, como los impactos del cambio climático, la pérdida de su hábitat, especies invasoras, una enfermedad llamada el síndrome de la nariz blanca, y turbinas eólicas.

Las principales amenazas que el cambio climático supone para los murciélagos de todo el mundo incluyen:

- mortalidad causada por los fenómenos meteorológicos más graves,
- mortalidad y una disminución del éxito reproductivo en las zonas que experimenten un aumento de la aridez y sequías, y
- cambios en el calendario estacional de los recursos alimentarios (por ejemplo, plantas floreciendo o la abundancia estacional de insectos) podrían afectar negativamente los murciélagos que migran (BCI, 2024).

El video *Murcielaguitos* destaca como las turbinas eólicas afectan los murciélagos. Aunque las turbinas eólicas utilizan un recurso renovable, el viento, y nos ayudan a reducir nuestra dependencia de los combustibles fósiles, se encuentran murciélagos muertos frecuentemente bajo las turbinas eólicas en todas partes del mundo. Aún no se sabe qué está causando la muerte de estos murciélagos cerca de las turbinas eólicas. Los científicos en el video *Murcielaguitos* están trabajando para entender este problema, y están investigando dispositivos diseñados para disuadir a los murciélagos de volar demasiado cerca de las palas de las turbinas.



Unas turbinas eólicas
Foto: "Fin & Fur Films Productions"

Carreras STEM

Las científicas que aparecen en el video cada una tiene un “PhD”. Esto significa Doctorado de Filosofía. El Doctorado es un título de investigación y representa uno de los niveles más altos de educación que se pueden alcanzar en un área de estudio. Las letras Ph en PhD no se refieren al sujeto de Filosofía, sino se conectan al significado original griego de la palabra filosofía, lo que significa aproximadamente “amante de la sabiduría.”

- [Dr. Sarah Fritts](#) - Profesora asociada, Texas State University

Dra. Fritts es una bióloga certificada en Fauna Salvaje. En su cargo actual como profesora asociada en Texas State University, ella imparte cursos de biología y conduce investigaciones. Sus investigaciones examinan cómo reaccionan las poblaciones de animales salvajes a los cambios medioambientales debidos al clima y al uso del suelo.

La educación de la Dra. Fritts incluye los siguientes títulos:

- Licenciatura (BS) en la Biología y Gestión de la Fauna Salvaje de la Universidad de Georgia
- Maestría (MS) en la Conservación de Peces y Vida Silvestre de la Universidad de Illinois Urbana-Champaign
- Doctorado (PhD) en la Biología de la Pesca, la Fauna y la Conservación de North Carolina State University

- [Dr. Sara Weaver](#) - Directora de recursos naturales en Bowman



Dr. Sara Weaver
Foto: “Fin & Fur Films Productions”

Dra. Weaver trabaja con Bowman Consulting, una empresa que apoya bienes raíces, energía, y proyectos ambientales por todos Estados Unidos. Ella dirige un equipo de especialistas que provee información a sus clientes sobre la expedición de permisos, las especies amenazadas y en peligro, y la gestión de la fauna salvaje.

Ella trabajaba anteriormente como conferenciante y profesora adjunta en Texas A&M University-San Antonio.

La investigación doctoral que condujo la Dra. Weaver se centró en entender y reducir las muertes de murciélagos cerca de las turbinas eólicas. Su investigación actual se centra en la integración de la tecnología en las estrategias de reducción del impacto de la fauna en el sector de las energías renovables.

La educación de la Dra. Weaver incluye los siguientes títulos:

- Licenciatura (BS) en la Biología de Texas State University
- Maestría (MS) en la Ecología de la Fauna de Texas State University
- Doctorado (PhD) en Recursos Acuáticos y Biología Integrativa de Texas State University

Tomar medidas

Aprender sobre los murciélagos y enseñar a los demás lo que has aprendido sería una buena manera de apoyar a los murciélagos y ayudar a los demás a entender las importantes funciones que desempeñan ellos en los ecosistemas.

“Bat Conservation International” (BCI) es una organización de conservación reconocida mundialmente, dedicada a acabar con la extinción de los murciélagos.

- [Visita el sitio web de BCI](#) para aprender más sobre los murciélagos.
- Experimentar los murciélagos a través de [sonidos de murciélago, una cámara en vivo, videos, y eventos con murciélagos](#).
- Aprende más sobre [el trabajo de BCI aquí](#).

Preguntas de discusión

Murciélagos

1. ¿Has visto alguna vez un murciélago en la vida real? Reflexiona sobre esa experiencia. ¿Dónde estuviste? ¿Qué viste? ¿Cómo reaccionaste al ver el murciélago?
2. ¿Estás de acuerdo con la siguiente declaración, o no? “Los murciélagos están malentendidos.” Explica.
3. El video *Murcielaguitos* muestra el surgimiento de más de 15 millones de murciélagos mexicanos de cola libre (una especie distinta de murciélagos) de la cueva Bracken situada a las afueras de San Antonio, Texas. Encuentra “Bracken Cave” en un mapa. ¿Cuánto tardarías en llegar desde tu casa o tu escuela?
4. Durante los meses de verano, los visitantes a la cueva Bracken pueden observar la salida de la población de murciélagos a buscar insectos cada anochecer. Mientras salen los murciélagos, vuelan en una formación que parece un tornado, ¡un tornado de murciélagos! Esto a veces se llama “batnado.” ¿Te gustaría visitar la cueva Bracken? ¿Por qué o por qué no?
5. ¿Cuáles funciones desempeñan los murciélagos en nuestro ecosistema? Enumera al menos dos.
6. Crea una red alimenticia mostrando cómo se transfiere la energía en un ecosistema. Incluye al menos un murciélago que come insectos (un insectívoro). Para el 7º Grado: Para investigar más a fondo la energía disponible en este ecosistema, también crea una pirámide de energía con los mismos organismos usados en la red alimenticia.
7. ¿Cuáles son algunas amenazas para las poblaciones de murciélagos en Texas? Enumera al menos tres.

El impacto de los cambios medioambientales

8. Enumera al menos un efecto ambiental positivo de las turbinas eólicas.
9. Enumera al menos un efecto ambiental negativo de las turbinas eólicas.
10. ¿Qué hace la gente para evitar que los murciélagos choquen con las turbinas eólicas?
11. Si las turbinas eólicas siguen matando murciélagos en Texas, ¿cómo afectará los ecosistemas de los que forman parte? Enumera al menos dos impactos.
12. ¿Cuáles son algunas ventajas económicas de la investigación sobre cómo prevenir la muerte de murciélagos cerca de las turbinas eólicas? ¿Cuáles son algunos beneficios de este trabajo?
13. Los elementos disuasorios ultrasónicos son una herramienta actualmente en uso para prevenir que los murciélagos vuelen demasiado cerca de las turbinas eólicas. ¿Puedes pensar en otra estrategia que podría ser usada para evitar que los murciélagos se choquen con las turbinas eólicas? Describe tu idea.

La jaula de vuelo: Ventajas & limitaciones de este modelo

14. El video *Murcielaguitos* muestra a la Dra. Sarah Fritts y su equipo poniendo murciélagos en una jaula de vuelo. ¿Para qué esta jaula se diseña a evaluar?
15. ¿Cuáles son dos ventajas de usar este modelo?
16. ¿Cuáles son dos limitaciones de usar este modelo?

Continúa en la siguiente página.

Carreras STEM

17. ¿A cuáles desafíos se han enfrentado la Dra. Sara Weaver y la Dra. Sarah Fritts a lo largo de sus carreras?
18. ¿Cuáles cosas les gustan la Dra. Sara Weaver y la Dra. Sarah Fritts acerca de su trabajo?
19. ¿Cuáles aspectos del trabajo de la Dra. Sara Weaver y la Dra. Sarah Fritts te gustarías? ¿Hay aspectos del trabajo que tal vez no te gustaran? Explica.

Nombre _____

Murcielaguitos

Respuestas a las preguntas de discusión

Instrucciones: Después de mirar el video, *Murcielaguitos*, contesta las preguntas de discusión. Para cada pregunta, primero escribe el número de la pregunta y luego escribe tu respuesta.

Sources (Fuentes)

- Bat Conservation International (BCI). (2024).
 - *About Bats*. <https://www.batcon.org/about-bats/>
 - *Climate Change. Bats 101*. <https://www.batcon.org/about-bats/bats-101/>
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 - *Visit Bracken Cave Preserve*. <https://www.batcon.org/see-bats-live/visit-bracken-cave-preserve/>
- Virginia Department of Wildlife Resources. (2024). *Bats: Frequently Asked Questions*. <https://dwr.virginia.gov/wildlife/bats/bat-faqs/>