The Bat Squad!

This activity is great as a follow-up to the Bat Squad! webcast, "Bat Chat! Join the Bat Squad!"

EXPLORATION QUESTION

What threats do bats face and how can you help them?

MATERIALS

- Bat Squad K-W-H-L Chart
- Bat Squad Student Reading Pages and Questions
- Bat Squad Service Learning Project Pages
- Bat Squad Pledge Card
- Planning and Assessing Your Bat Squad Service Learning Project Student Worksheets
- Library and Internet Access for Student Research

OVERVIEW

Students will explore the value of bats in our environment, their habitat needs, and the threats that they face in the wild. After discovering the effects of these threats on bat populations, students will have the opportunity to take personal action to aid bat survival. Students will explore service learning activities that they can take in their backyards and communities to help bats, commit to participating in bat conservation projects, and challenge other students, schools, and organizations to do the same.

VOCABULARY

bioaccumulate, biodiversity, echolocation, ecosystem, endangered, extinction, habitat, hibernation, insectivores, invasive, native, non-native, pesticide, pollination, roost, threatened, ultrasonic

GROUP SIZE

Any

AGE

13 and above

Background

Background – Service Learning

Service learning is a teaching and learning strategy that allows students to learn by designing, organizing, implementing, and participating in real-world community service experiences. Effective service learning integrates a variety of subject areas (science, math, social studies, writing/speaking, etc.), provides opportunities for cooperative learning, critical thinking, student leadership, and the development of conflict resolution skills. When students use their skills and knowledge in real-life situations, learning extends beyond the classroom and into the community.

Linking community service to classroom curriculum provides numerous opportunities for personal, social, and intellectual growth as students identify and analyze problems, select projects, establish goals, and take action. Service learning also includes structured time for reflection, where students consider community needs and ways to help. And, once their service has been completed, they can internalize how their efforts have made a difference, all while making educational connections.

Once the service activity has been successfully completed, it is time for the final component - celebration. Taking time to recognize students for their contributions either through award ceremonies, special assemblies, or media coverage is an important step in closing out a service learning project. By showing students that what they are doing in the classroom is affecting their community, they will learn that the things they think and do really matter. Service learning is a way to make learning more meaningful, more purposeful, and more lasting. We invite you to educate, inspire, empower, and build productive and caring students!

Best Practices of Service Learning

1. Meet a Recognized Need in the Community/Environment
2. Achieve Curricular Objectives for Multiple Subject Areas
3. Reflect throughout the Service Learning Project about the Experience
4. Develop Student Responsibility
5. Establish Community Partnerships
6. Equip Students with Knowledge and Skills Needed for Service
7. Celebrate Success

Help Bats – Service Learning Projects

There are many different ways to help bats and they are all important. All of these actions can help protect bats living in your backyard or in your community. Students are often most successful when they focus on projects that are important to them and that occur in their own neighborhoods. Because everyone has very different skills, resources, capacities, interests, and time, a variety of opportunities are presented in this activity. The Bat Squad Service

Learning Project pages provide information on actions that can be taken to help protect bats. But, we are only providing a starting place. Students should be encouraged to develop their own ideas. And, if they are creative, we may feature them in later versions of this activity. Please consider periodically checking the "Bats Live" website at http://batslive.pwnet.org/edubat/curriculum.php to see our new updates to this activity.

Service learning projects are exciting and challenging at the same time. To support you and your students, you might want to read the Project WILD publication, "Taking Action: An Educator's Guide to Involving Students in Environmental Action Projects." This guide can help educators plan, implement, and evaluate environmental action projects.

Get Ready – Gather Materials

1. Make a copy of the Bat Squad K-W-H-L Chart, Join the Bat Squad Student Reading Pages, Student Reading Questions, Bat Squad Pledge Card, Planning Your Bat Squad Service Learning Project Student Worksheet, and Assessing Your Bat Squad Service Learning Project Student Worksheet for **each student**.

2. Make a copy of all the Bat Squad Service Learning Project pages for **each group/team**.

3. Read the "Join the Bat Squat Student Reading Pages" included in this packet before you begin this activity to help you prepare.

4. Pick your favorite "Meet the Bat Squad!" profile about a student who has completed a Bat Squad Service Learning Project. Read the spotlight aloud to your students to generate excitement. We have included four profiles in this activity; however additional profiles are available at: http://batslive.pwnet.org/edubat/curriculum.php. You might review these profiles to select a student that is located in or near your state or a project that a student has completed that you think will resonate with your students.

5. Plan ahead to ask for support for Bat Squad Service Learning Projects. Projects are likely to be more successful and better understood if you (and later, your students) ask for support for projects as early in the process as possible. You can inform teacher colleagues, administrators, parents, community members, and business owners that students will be choosing and beginning Bat Squad Service Learning Projects. Ask these people to be ready to consider student requests for their expertise, time, materials, and encouragement.

Get Set –Exploring Interests

1. Provide students with copies of the K-W-H-L Chart and have each of them list what they already **know** about bats, the threats they face, and why they are important in the "K" column. Examples could be their ability to use echolocation, they are nocturnal mammals, they eat tons of insects that harm food crops, or that bats are losing a lot of their habitat as the human population expands.

2. Ask the students questions like, "Have you ever seen bats flying in your backyard or in the woods? Have you ever gone to see a bat flight? Have you seen a video online about bats?" Encourage them to write down additional information about bats based upon these experiences in the "K" column.

3. Ask students what types of things they **want** like to learn about bats. They should write down their answers in the "W" Section of the K-W-H-L Chart. These answers will help guide their research and project development later in this activity.

4. Provide each student with a copy of the "Join the Bat Squat Student Reading Pages" and Student Reading Questions.

5. After they finish the reading, ask students to complete the reading comprehension questions.

6. Briefly discuss some of the reasons that bats are important such as ecological, scientific, economic, and aesthetic values. Also, discuss a few of the threats to bats such as White-Nose Syndrome.

7. After these discussions, have the students record additional topics that they **want** to learn about bats in the "W" section of the K-W-H-L Chart.

8. Read your favorite "Meet the Bat Squad!" profile to your students to provide an example of a student that is already active in helping bats.

9. Ask students how this Bat Squad member **helped** bats. Ask them to share their ideas on other ways to help bats. They should write down their answers in

the "H" Section of the K-W-H-L Chart.

Get Even More Set – Committing to Action

1. Divide the class into action teams of 3-5 students. Provide a set of "Bat Squad Service Learning Project Pages" to each group. Each team will read these pages and select one project for further research that they will develop into a service learning project. They should select a topic that matches something they wanted to learn more about in their K-W-H-L Chart. It is okay if teams select the same projects to research. After selecting a project, have the students add any new ways that they could **help** bats in the "H" section of the K-W-H-L chart.

2. Provide each team with "Planning Your Bat Squad Service Learning Project Student Worksheet." Have the students answer the first two questions on this worksheet to help them identify the type of problem or threat that they want to focus on with their project.

3. Have students commit to taking action! Provide each student a "Bat Squad Pledge Card." Ask them to complete the card selecting some quick and easy actions that they can take to help bats. Be sure that they also select the action that corresponds to their service learning project. This will allow them to complete smaller actions as they work towards planning and implementing their major project. Encourage students to share their pledge cards with their friends and family.

Go! – Plan and Start Bat Squad Service Learning Projects

1. Set a firm deadline for the completion of the student learning projects. Having this date in place will help students as they begin planning their projects.

2. Working as a team, students plan projects using the "Planning Your Bat Squad Service Learning Project Student Worksheet." Students should complete items 3 – 10 at this time. Tell the students they can use the information on the project pages as a starting point to plan their projects; however, they will also need to complete further research. When they are doing research, students should be asking each other, "Can we plan a project with this information? Do we need more information? What kind of resources will we need to complete this project? Is this project feasible?" Encourage students to modify their original plans if necessary.

Additional research topics are included at the end of each project page. These can be used to stimulate discussion or to guide research. For teams that need more direction, suggest that students focus on the topics that they identified in the "W" Section of their K-W-H-L Chart.

3. Encourage your student groups to be creative as they decide how to plan and implement their projects. They do not need to complete all the actions presented in the "Bat Squad Service Learning Project Pages." They can pick the pieces that they are most interested in and/or add additional items that match the overall goal of their project. "The Planning Your Bat Squad Service Learning Project Student Worksheet" and the "Assessing Your Bat Squad Service Learning Project Student Worksheet" will provide a framework to help students develop their projects and will also assist you in evaluating the final outcomes.

4. Set a deadline to review the final project plans for each group. This would include assessing their responses to items 1-10 on the "Planning Your Bat Squad Service Learning Project Student Worksheet."

5. After you have reviewed the project plans, tell students to begin implementing their projects. Remind them to follow their approved project plans, but be ready to support students that need to modify their projects to meet unexpected challenges.

6. Encourage students to keep a written journal and take photographs of their work. These completed resources can be used to help you evaluate the effort that was contributed to the project, especially if there is an unforeseeable issue that results in the project not being implemented. Suggestions to guide students include:

Student Journal
Keep a journal about the project. Make journal entries:

- When you work on a specific task
- When you complete a project objective
- When you encounter a problem and when you develop a creative solution
- Whenever you have general observations

- and/or feelings you think are important and/or interesting
- When you interact with others outside of the classroom about bats

Student Photographs and/or Artwork
Create an image log for the project.

- Take before/after photos or create drawings if your project will change the look of an area
- Take photos of people working on specific tasks and objectives
- Create illustrations or other art work that could be used to help market your project
- Take photos of fun stuff, too!

Celebrate – Reflect on Student Success

1. After projects are completed, students should take time to reflect on what they learned during their projects about bats, the threats they face, and how actions both big and small can help them. Discuss the facts that they learned through their research and service learning projects that most surprised them. Ask the students "What did you learn about the environmental issue you addressed through your service?" How did your efforts support bat conservation and provide a benefit to your school or community? What did this service-learning experience teach you about your role as a citizen in the community? Students should record their answers in the "L" Section of the K-W-H-L Chart. Additional questions are included on the "Planning Your Bat Squad Service Learning Project Student Worksheet" under item number 12 to help guide these discussions.

2. Celebrate success! Consider hosting a special event at your school to highlight completed projects. Or, help students share their projects with the community by connecting them with local media (radio, news, TV). To help, we have created a draft press release that you can modify for your use. The press release template is available at: http://batslive.pwnet.org/edubat/curriculum.php.

3. Encourage your students to post pictures of their final projects on the Project EduBat Facebook page at: https://www.Facebook.com/ProjectEduBat. They can share their insights about bats and the value of making a difference in their school or community. Pictures or artwork that were created as a part of the project would make great posts and could inspire other students around the world to take action.

4. Urge your students to become official members of the "Bat Squad" when they have completed their project. They will receive a Bat Squad membership patch when their projects are reviewed and approved by our staff. Students can submit the following information to Cynthia Sandeno at cmsandeno@fs.fed.us:

- Copy of a completed Planning Your Bat Squad Service Learning Project student worksheet.
- Copy of a completed Assessing Your Bat Squad Service Learning Project student worksheet
- Photo release form (on EduBat website)
- Copy of a Teacher's Certification of Completion (on EduBat website)

5. Submit extraordinary projects for potential inclusion in updated versions of this "Bat Squad" Activity. Students and their projects would be highlighted in the Bat Squad profile and service learning project pages.

6. Enter our annual competition to win the prestigious, "Superheroes of the Night Sky" award. Schools and students may submit completed projects for a chance to win within one year of finishing the project. The winning school or student will receive a traveling award trophy that they can display at their school/home for one year. Winners will also receive a bat house that could be placed at their school or in a community greenspace. This is a great way to gain national recognition for a job well done!

Student Evaluation

1. Completely recorded data in all columns of the K-W-H-L Chart.

2. All questions answered correctly and completely on the Bat Squad Student Reading Questions page (Refer to "Teacher Answer Pages" for recommended answers).

3. Completely answered each section of the Planning Your Bat Squad Service Learning Project student worksheet.

4. Completely answered each section of the Assessing Your Bat Squad Service Learning Project student worksheet.

5. Thoughtful entries recorded in student journals and photographic/artistic documentation of project.

Go even further! – Pay It Forward

Your students have discovered the value of bats in our environment and have taken actions to help protect them. They have learned that one person can make a difference regardless of their age, background, money, or social status. They also have a better understanding of why it's important to get other people involved in helping bats. After they have completed their Bat Squad Service Learning project, encourage your students to "pay it forward" by challenging other students/schools/organizations to take action. Imagine the difference that would make! Together, we can change the world – one good project at a time.

Ask your local newspaper/television/radio media to cover your students' Bat Squad projects. You can request that part of the coverage include your challenge to other students/schools/organizations to complete a Bat Squad project. Also, consider offering your assistance by being a Bat Squad Mentor. You can help those you challenge get their projects started, tell them about what you learned (and what mistakes you made), and be an encouraging voice of experience to keep them motivated to complete their project.

Further Reading and Resources – Discover More

About Environmental Action Projects

Taking Action: An Educator's Guide to Involving Students in Environmental Action Projects. Project Wild: http://www.projectwild.org/Takingaction.htm

About White-Nose Syndrome

Battle for Bats: Surviving White-Nose Syndrome: http://vimeo.com/76705033

National White-Nose Syndrome (WNS) Website: http://whitenosesyndrome.org/

National Wildlife Health Center – http://www.nwhc.usgs.gov/disease_information/white-nose_syndrome/

About the Value of Bats

Bats are Important - http://www.batcon.org/why-bats/bats-are/bats-are-important

Bats Role in Pollination - http://www.batworlds.com/bat-role-in-pollination/

Pollinators - http://www.fs.fed.us/wildflowers/pollinators/animals/bats.shtml

Ecological and Economic Value – http://www.hindawi.com/journals/isrn/2013/187415/

Ecosystem Services – https://caves.org/WNS/WNS%20Kunz%20April%205%20%202011.pdf

Why Bats Matter - http://www.bats.org.uk/pages/why_bats_matter.html

Teacher Answer Pages

LITERAL QUESTIONS:

1. Are there reasons why people today should care about bats? Use evidence from the text to support your answer.

There are many reasons why people today should care about bats. Reasons include:

- Bats eat insects that are serious agricultural or forest pests and others that spread disease to humans or livestock. Bats save billions of dollars in pest control simply by eating insects.
- Bats are critical pollinators of over 500 plant species, including plants of great economic and ecological value.
- Fruit-eating bats disperse seeds that are critical to restoring rainforests that have been cleared for agriculture, logging, ranching or other uses.
- Bats play a significant role in science and medicine. Research conducted on bats has led to advancements in sonar, ultrasound technology, and more
- Bats face a multitude of threats including habitat loss, disturbances while hibernating, pesticide contamination, death from wind turbines, intentional killing, and White-Nose Syndrome.

2. Why are bats important to agriculture? Provide evidence for your conclusion.

- Bats eat insects that are serious agricultural or forest pests and others that spread disease to humans or livestock. Bats save billions of dollars in pest control simply by eating insects.
- Bats are critical pollinators of over 500 plant species, including plants of great economic and ecological value.

3. How do bats hunt flying insects at night? Use evidence from the text to support your answer.

- Bats use echolocation, emitting very high pitched sounds (higher than human hearing) that bounce off obstacles in their path. Bats make these calls as they fly around, and they listen for the returning echoes. Bats use the reflected sounds to identify what an object is, how big it is, and what direction it is moving.

4. What role do bats play in helping new forests grow?

- Fruit-eating bats disperse seeds that are critical to restoring rainforests that have been cleared for agriculture, logging, ranching, or other uses. Night-foraging fruit bats often cover large distances each night and are willing to travel across clearings. These bats defecate in flight, scattering seeds much farther across cleared areas than birds. Bats are so effective at dispersing seeds into these devastated forestlands that they've been called the "farmers of the tropics." Seeds dropped by bats can account for up to 95 percent of the first new growth of recovering forests.

INTERPRETIVE QUESTIONS:

Answers will vary. Students might include the following ideas in their answers.

5. What might the continued spread of White-Nose Syndrome mean for bats, humans, and the environment?

- The economic and environmental consequences of the loss of North American bats could be devastating. Bats provide critical ecosystem services by eating night-flying insects that are serious agricultural or forest pests and others that spread disease to humans or livestock.
- Loss of our bats could result in crop losses and increased pest control costs such as increased pesticide use.
- Removing large numbers of bats from the food chain could have implications for predator and prey relationships and population dynamics. Scientists are just now studying these effects.

6. What could insects do to avoid bats? Can you think of ways to avoid being detected by echolocation?

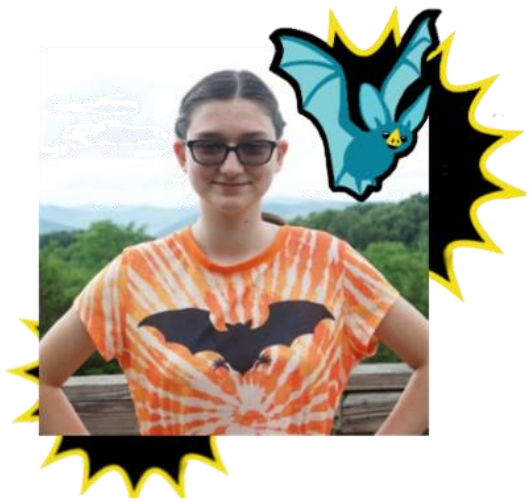
- We are still learning a lot about the response of insects to echolocation. Below are some of the things we have learned. Encourage your students to try to think of creative ways to avoid detection and accept answers that are plausible for bats. Here are a few real adaptations:
- Some insects have actually learned to jam the sonar of bats. When approached by bats, some moths produce their own ultrasonic clicking sounds, blanketing the surrounding environment and cloaking themselves from sonar detection.
- Luna moths have two long frills on the end of their wings that spin in flight. Scientists have just discovered that these “tails” garble bats’ sonar cries, causing the bats to miss the tasty mark.
- Some moths have evolved furry wings that don’t reflect bat echolocation pulses.
- Some moths have developed sensitive membranes that can detect the echolocation pulses of bats and when such pulses are detected the moths may fly in erratic patterns or fold their wings and dive to confuse their hunters.

7. Do you agree that anyone can become a hero and help bats? What role could you play in helping bats? What if you worked with others?

- Yes! Anyone can become a hero and help bats! Because your students might just be beginning to learn about bats, they might not yet have a clear understanding of what they might do to help bats. If you started the lesson with a Bat Squad member profile, they might cite that example. Hopefully they will agree that working with others would help them to help bats.

8. Are bats an important part of the earth’s biodiversity?
Yes! Worldwide, there are more than 1,300 species of bats or about 20% of all mammals. They come in all shapes and sizes, from the tiny, bumblebee bat that weighs less than a penny to the big, Malayan flying fox that can have a wing span of up to six feet. Bats can be white, brown, black, gray, red or even spotted or striped! Some bats have big eyes and long slender snouts that help them reach deep into flowers for nectar. Other bats have small eyes and large ears to help them echolocate.

Meet Bat Squad Member, Rachel Block!



Age: 14

Hometown: Fairfax, VA

Time working with bats: over 4 years

I got excited about bats when: I got excited about bats because they were living outside my front door. We would walk by them to get into the house. It was a lot of fun to watch them in the evening because they would wake up and squeak at me. They were fun to watch because they all had different personalities. Some liked to be looked at and some always hid. It was a lot of fun to watch them climb up the brick wall because I could see their wings.

Advice for kids who want to help bats I think the easiest thing for kids to do is talk to people about how cool bats are. The more people they can convince, the more help bats can get. If kids really want to actively help, they should contact their local wildlife rehabilitator and ask what they need. Depending on where you live, there are different bats and different needs. One of the things I did with my Girl Scout project was to sew little bat sleeping bags for bats in rehabilitation. It was an easy project that even the youngest scouts could help with. Kids everywhere could do that. The most important thing is that they should work with an adult.

My Bat Squad Service Learning Project

The challenge/problem: People are afraid of bats often without knowing anything about them.

My solution: I write a weekly blog about bats for the Save Lucy Campaign, so I am constantly researching bats on-line and trying to learn more about them. My blog is called the Baturday News. I try to teach my readers about all things batty. I talk about different kinds of bats, how people can help bats and anything else I can think of that will get people interested in bats.

Telling others about bats: My blog tells people all about bats. I also did my Girl Scout Silver Award project on bats. I led workshops for younger Girl Scouts to teach them about bats and how they aren't scary. I also taught them about how kids can help bats. Plus, I talk to my friends about bats and try to convince them they aren't scary creatures like in the movies.

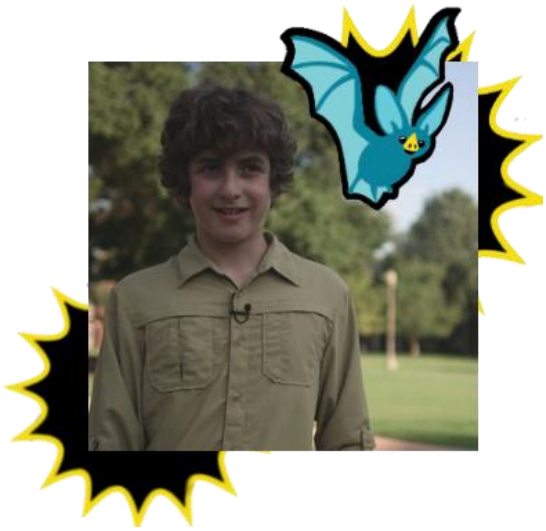
How will you help bats in the future: I plan to continue blogging and teaching people about bats. I might also become a rehabilitator when I am old enough.

Funny story about bats or something that happened when you were studying or helping bats: Nothing has really happened to me, but it is sometimes funny to watch the rehabilitator get fussed at by a grumpy bat who doesn't want to be bothered. They need to be handled to be examined and they don't really like that. So, they squeak and fuss, but they are so tiny that it's a little funny.

One thing I wish everyone knew about bats: I wish everyone knew how important bats are. Humans need bats in order for us to survive.

My eight words to describe bats: Interesting, fascinating, diverse, misunderstood, cute, important, winged, and unique

Meet Bat Squad Member, Logan Carter!



Age: 12

Hometown: Muncie, IN

Time working with bats: over 6 years

I got excited about bats when: I got excited about bats because they are so amazing. They are the only mammal that can truly fly and they have a sixth sense called echolocation. It would be pretty amazing to have a built in sonar.

Advice for kids who want to help bats Just find a thing about bats that you want to understand and learn more about it. At first keep it simple, just the facts….and then add a little fun to it! To be honest, everything about bats is pretty cool.

My Bat Squad Service Learning Project

The challenge/problem: Everything about bats is pretty cool and most people don't know it!

My solution: I have not done any research, but I have been around bats my whole life. My dad is a bat biologist and I have been able to help him at educational events and I have gotten a chance to go netting for bats. I can't touch the bats, but I can watch them. I help my dad at bat festivals and I am a part of the "Be a Bat Biologist" exhibit where I show other kids how scientists learn about bats.

Telling others about bats: I have been able to show other kids what it is like out in the field for bat researchers. I also tell my friends all about bats.

How will you help bats in the future: I do not know. Things are changing fast enough that I can't plan what to do!

Funny story about bats or something that happened when you were studying or helping bats: Sadly I do not…. but I wish!

One thing I wish everyone knew about bats: Are bats scary: No! Are bats awesome: Yes!

My eight words to describe bats: Interesting, cute, helpful, misunderstood, smart, strong, playful, and swift

Meet Bat Squad Member, **Madison Mies!**

Age: 14

Hometown: Lake Orion, Michigan

Time working with bats: 11 years

I got excited about bats when: I love how amazing bats are and how there are so many different species with an array of colors, sizes, and appetites.

Advice for kids who want to help bats: There are so many things kids can do to help. You can visit batconservation.org to find plans on bat houses, join the bat club, sponsor a bat, and donate money to fund research to save the bats. Kids can plant bat gardens to give bats a healthy place to find food. In return, bats will eat many of the garden's pests. Kids can also build bats houses to give bats a great place to live, where White Nose Syndrome does not occur. And lastly, kids can educate their friends and family and inspire people to help raise money for bats.

My Bat Champion Service Learning Project

The challenge/problem: People are afraid of bats often without knowing anything about them.

My solution: I have been learning about bats since I was three and I try to talk to as many people as possible about why they are important. I am a volunteer at the Bat Zone at the Cranbrook of Science where I get to introduce people to bats and tell them how different and amazing bats are. I went to Costa Rica and did a fantastic tour through the rainforest, while seeing many wondrous bats. I had an opportunity to meet Zach Snyder and Amy Adams (Actress) and the cast and crew of Batman vs. Superman. Together, we took pieces of the set of the movie and turned them into bat houses. These bat houses were sold to make money to help bats. You can watch a video of the project at: https://www.youtube.com/watch?v=lVIpW25r9uY

Telling others about bats: I have recently given a TEDx talk about bats, which promoted helping bats and educated people about their importance. I have also been to libraries, schools, and museums to talk about bats with my dad. One of the most exciting events is the bat festivals, where I work at every year.

How will you help bats in the future: I hope to spread more information about bats to other countries where they fear bats. I also want people to donate to help find a cure for WNS because it is a big problem for bats.

Funny story about bats or something that happened when you were studying or helping bats: Well, my first bat I ever held was a baby vampire bat, which is surprising to some people because they think bats are scary. I was only 3 years old when I held him!

One thing I wish everyone knew about bats: I wish everyone knew that bats are very beneficial and should not be feared. They are actually pretty adorable and fantastic!

My eight words to describe bats I would use the words amazing, beneficial, intriguing, unique, awesome, intelligent, social, cute, and lastly, inspirational.

Meet Bat Squad Member, Alexis Valentine!
(a.k.a Bat Girl)

Age: 14

Hometown: Gatlinburg, TN

Time working with bats: 6 years

I got excited about bats when: I went on my first bat netting trip when I was in third grade with Dr. Joy O'Keefe from Indiana State University. The first bat we caught was a northern long-eared bat. It was love at first bat!

Advice for kids who want to help bats: Anything is helpful. Host a bake sale at your school or a grocery store and donate the proceeds to a bat conservation group. Create posters about bats and conservation and display them at local businesses and at school.

My Bat Squad Service Learning Project

The challenge/problem: White-Nose Syndrome is a terrible disease that has been killing bats. It is awful. I wanted to get information about bats that live near me before they were gone because of this disease. So, I started my own research project.

My solution: I spent three years conducting research in the Great Smoky Mountains National Park. I used bat detectors called SM3 by Wildlife Acoustics to record the ultrasonic calls of bats. I put them out in the park and then analyzed the calls to see if there were increases, decreases, or no changes in the bat populations.

Telling others about bats: I give speeches to my classmates whenever I can and I do a presentation at the local Rotary club each year on bat conservation and the details of my latest research. I wear bat t-shirts a lot and talk about bats to anyone who will listen. I have also helped with the Bat Booth at the Knoxville Zoo educating others about bats. I really like to talk to kids especially pre-K and Kindergarten. They get so excited and it is fun to get them started doing things to help bats.

How will you help bats in the future: Cure the deadly fungus that causes White-Nose Syndrome. I also want to help educate others about bats and conservation.

Funny story about bats or something that happened when you were studying or helping bats: On one of my first bat netting trips, while helping put up bat poles, I slipped and fell in the water. My pants got wet and it looked like I was so excited to see the bats that I peed myself. But, it was really just my clumsiness.

One thing I wish everyone knew about bats: Bats are very intelligent and we need them. They are not blind and they are the only mammals that can fly. Sorry. I couldn't stop at just one!

My eight words to describe bats: cute, important, unique, mammals, echolocation, fun, soft, and nocturnal.

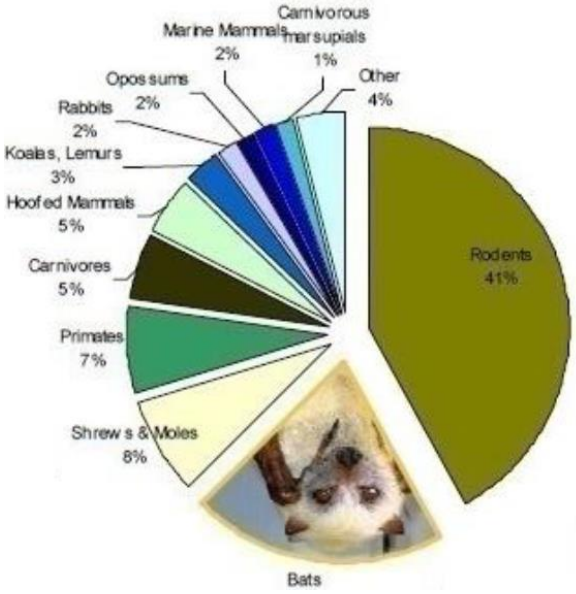
Join the Bat Squad – Student Reading Pages

In movies, when the world needs saving there is always a superhero waiting to swoop in and get the job done. Have you ever imagined yourself as that superhero? Maybe you are the masked man that rides in on a horse to save the day or a caped crusader flying to the rescue of those in need.

There is a real need to protect our environment and to help wildlife, especially misunderstood species like bats. And, the great news is that you do not have to have extraordinary powers or a lot of money to help them. There are many actions both great and small that you can take to help conserve bats and the places where they live, and all these actions are all important.

Bats are amazing animals that are vital to our health and the health of our environment and economy. At dusk, as the birds and bees settle in to rest, bats spread their wings and take to the night sky. Although we may not always see them, bats are hard at work every evening - eating tons of insects, pollinating flowers, and spreading seeds that grow new plants and trees.

Worldwide, there are more than 1,300 species of bats. That's almost 20 percent of all mammal species! They come in all shapes and sizes, from the tiny, adorable bumblebee bat that weighs less than a penny to the big, beautiful Malayan flying fox that can have a wing span of up to six feet. Bats can be white, brown, black, gray, red or even spotted or striped! Some bats have big eyes and long slender snouts that help them reach deep into flowers for nectar. Other bats have small eyes and large ears to help them echolocate.



Echolocation is a remarkable navigation system that most bat species have developed to help them detect obstacles in flight, find their way to their homes, and hunt down their main target – delicious insects! Contrary to popular belief, bats are not blind. They actually have good eyesight (similar to that of humans), and some bats use their eyes to find food. But, for bats that eat insects, eyesight doesn't help much when flying through the forest at night. Instead, they use echolocation, emitting very high pitched sounds (higher than human hearing) that bounce off obstacles in their path. Bats make these calls as they fly around, and they listen for the returning echoes. Bats use the reflected sounds to identify what an object is, how big it is, and what direction it is moving.

Echolocation is only one of the amazing adaptations that make bats so fascinating. Bats fly. They don't glide, they actually fly! Other mammals such as the "flying" squirrel" and "flying" lemurs actually glide or parachute by means of a furred membrane. This means that they have to climb a tree or other tall object to be able to glide. Only bats have the structural adaptations that allow for full powered flight.

Flight has enabled bats to become one of the most widely distributed groups of mammals. Bats live almost everywhere on Earth. The only places they are not found are the regions surrounding the North and South poles, and a few remote islands. This means that no matter where you live, there are almost certainly bats living near you.

Flying and echolocation require a lot of energy and make bats really hungry. So come nightfall, bats are busy searching for and eating all kinds of foods. Most bats in North America eat insects, including moths, beetles, aquatic insects, flies, and, of course, mosquitoes. Many of these insects are serious agricultural or forests pests, and others spread disease to humans or livestock. Bats even help protect our forests by eating native and non-native invasive species such as gypsy moths and emerald ash borers. These insect pests can decimate our forests if they are left unchecked. Every year, bats save us billions of dollars in pest control simply by eating insects.

In addition to insect control, bats serve other important ecological functions. From deserts to rainforests, nectar-feeding bats throughout the world are critical pollinators. Drawn to pale, night-blooming flowers, pollinating bats bury their furry faces in flowers to lap up the tasty nectar. When they pull their faces out, they are covered with pollen that they carry to the next flower they visit. Through this process, known as pollination, plants are able to produce full-bodied fruit and viable seeds. While many people know that birds and bees are important pollinators, few know that bats are, too. In fact, over 500 plant species rely, at least partially, on bats to pollinate their flowers, including some plants of great economic and ecological value such as wild bananas, cloves, cashews, balsa wood, and agave.

A lesser long-nosed bat pollinates a saguaro cactus flower. Photo by Merlin D. Tuttle. Bat Conservation International.

In the tropics, fruit-eating bats disperse seeds that are critical to restoring rainforests that have been cleared for agriculture, logging, ranching, or other uses. The recovery of these forests requires seed-scattering by birds, primates, bats, and other animals. Birds are often wary of crossing large, open spaces where flying predators can attack. They usually drop seeds directly beneath their perches. Yet, amazing, night-foraging fruit bats often cover large distances each night and are willing to travel across clearings. These bats defecate in flight, scattering seeds much farther across cleared areas than birds. Bats are so effective at dispersing seeds into these devastated forestlands that they've been called the "farmers of the tropics." Seeds dropped by bats can account for up to 95 percent of the first new growth of recovering forests. This makes bats vital to restoring rainforests around the world. Between their role as predators of night insects, pollinators of night blooming flowers, and seed spreaders across damaged landscapes, bats truly are heroes of the night skies.

While bats have many remarkable abilities, they do not have superpowers. And, they are not indestructible. In fact, bats are in decline nearly everywhere they are found. These amazing animals face a multitude of threats including habitat loss, disturbances while hibernating,

pesticide contamination, death from wind turbines, and even intentional killing due largely to fear and misunderstanding. White-Nose Syndrome (WNS), one of the greatest threats to bats in North America, is killing bats as they hibernate in caves and mines. Many insect-eating bats survive winter by going into hibernation. During this process, their body temperatures are lowered and the bats depend entirely upon fat deposits that were built up during the summer and fall. More than half of the bats that live in the United States hibernate in caves and mines to survive the winter. The economic and environmental consequences of losing so many bats could be devastating. Bats need our help!

This is your chance to become a hero to bats and the environment. The Bat Squad is a group of young people, just like you, who are working to help bats. They do this in many different ways and they are all equally important! Some create bat-friendly habitat, others have dedicated their science fair projects to bats, and some work to educate their friends, family, neighbors, and community about the importance of bats. All of these actions can help protect bats living in their backyards and in their communities. And, they are looking for new members!

By committing to take actions to help bats, you could become an elite member of this amazing team. You can also challenge other students, schools, and organizations to participate in bat conservation activities. When you involve more people in your actions, there will be more people who understand the value of bats and who might take action themselves. You don't need super powers to make a difference. By working with your classmates and teacher on a bat project, you have the opportunity to join the Bat Squad and be a Bat Hero!

Student Reading Questions

Join the Bat Squad! Student Name:_____

LITERAL QUESTIONS:

1. Are there reasons why people today should care about bats? Use evidence from the text to support your answer.

_____

_____

_____

_____

_____

2. Why are bats important to agriculture? Provide evidence for your conclusion.

_____

_____

_____

_____

3. How do bats hunt flying insects at night? Use evidence from the text to support your answer.

_____

_____

_____

_____

4. What role do bats play in helping new forests grow?

_____

_____

_____

INTERPETIVE QUESTIONS:

5. What might the continued spread of White-Nose Syndrome mean for bats, humans, and the environment?

_____

Student Reading Questions

6. What could insects do to avoid bats? Can you think of ways to avoid being detected by echolocation?

7. Do you agree that anyone can become a hero and help bats? What role could you play in helping bats? What if you worked with others?

8. Are bats an important part of the earth's biodiversity?

8. Write a question about the story for your teacher or another student to answer.

K-W-H-L Chart

Join the Bat Squad **Name** _____

In the first two columns, write down what you already **know** about bats, the threats they face, and why they are important (**K**) and what you **want** to learn more about (**W**). You will add additional topics that you would like to learn about bats after you complete the student reading. You will write your ideas about ways you can **help** bats in the third column (**H**). After you have completed your research and service learning project, write what you **learned** in the fourth column (**L**).

What I Know (K)	What I Want to Know (W)	How I Can Help Bats (H)	What I Learned (L)

Bat Squad Service Learning Project - Create Bat-Friendly Habitat

With declining habitats, bats need places to find food, shelter, space to raise their young, and water. You can help by turning your yard, school yard, or other green space into a safe and inviting place for bats. Even the smallest spaces can provide a home for bats. In return, you'll receive lots of batty benefits!

Bats make great neighbors! You can receive many valuable services by attracting them to your yard and garden. Every night, bats eat tons of insects, including mosquitoes and garden pests. In addition, some insects can hear bats and will avoid the areas where they are feeding. Bats are a sign of a healthy environment, so creating a yard that is good for bats will also be good for you. And, bats definitely need our help.

Unfortunately, many bat species are in decline. More than half of the bat species found in the United States are considered at risk due to disturbance during the summer and winter, habitat loss, pesticide use, and disease. While we cannot stop all of these threats at once, we can make a difference by making our yards and gardens favorable to bats. If we provide the habitat, they will provide natural insect control. Attracting bats can be easy and fun and is a great way to help bats at home, at school, or within your community. We offer several different ways that you can help create bat-friendly habitat.

The first thing to consider when attracting bats is the bats' life needs. An animal's habitat is the place where all of its needs are met. To find out if your property is good bat habitat or not, think about what bats need to live. Is your home close to water? Do you have places for the bats to roost? Is there a food source for bats?

Trees for Bats

Many people believe that bats live in caves, and that's partially correct. Many species of bats do live in caves, although some only hibernate there during the winter. Some bats live in dead, hollow trees while others live in the cracks, crevices, or under loose bark of live trees. Other bats just hang from the branches of trees. Bats like the hoary bat have colorful fur that allows them to blend in with the surrounding tree foliage.

To attract bats to your property, and discourage them from living in areas where they are unwanted, create good habitat. Natural habitats are the best! Leave dead trees standing in your yard if they do not pose a safety hazard. Or, consider planting trees that are native to your area. Bats need a safe, warm place to rest and to raise their young during the summer – called roosts. Live and dead trees can provide safe roosts for bats. Because most of our bats only have one baby a year, having a safe roost is vital to long-term survival. You can help make a difference by providing bats with a natural home – a tree.

Trees will also support a large variety and abundance of insects that are important for bats (and birds too) that are hunting for a meal. Studies show that native trees produce more insect prey than do non-native tree species. And, older native trees support the greatest abundance of insects.

If you are planting trees, let nature be your guide. Try to copy what you see in the natural world by planting trees in groups instead of planting isolated, individual trees.

You can even plant corridors to connect islands of trees with other natural areas. When done correctly, you can provide critical habitat for bats and other wildlife and beautify your yard at the same time. If you don't have a place to plant trees, don't worry. You can always volunteer at a national forest or wildlife refuge, nature preserve, or other public places. There are many volunteer tree planting events around the country and your help will be greatly appreciated.

Water for Bats

Over the past 150 years, the availability of water has drastically changed around the world due to many factors including irrigation for farming, increased development (homes, shopping centers, roads, etc.), damming for irrigation and flood control, and more. This loss of natural water resources can make an area unusable by wildlife. In areas where water is limited, developing water sources for wildlife, especially bats, can be very important. Bats prefer to roost within ¼ mile of water. If you do not live near a river, lake, or other source of fresh water, consider adding a small pond or water garden to your property. For smaller backyards, install a bird bath or other container filled with water. Remember to change the water regularly.

Bats do not stop and land to take a drink of water. They must drink on the wing! They do this by flying down to the water's surface, lapping up water, and continuing to fly away. This means that bats need a flight path that is clear of obstacles that could prove deadly. Like many animals, bats are very susceptible to drowning if they get trapped in a water source without an escape route. When creating a water source, be sure to include a ramp or other feature to help bats and birds escape.

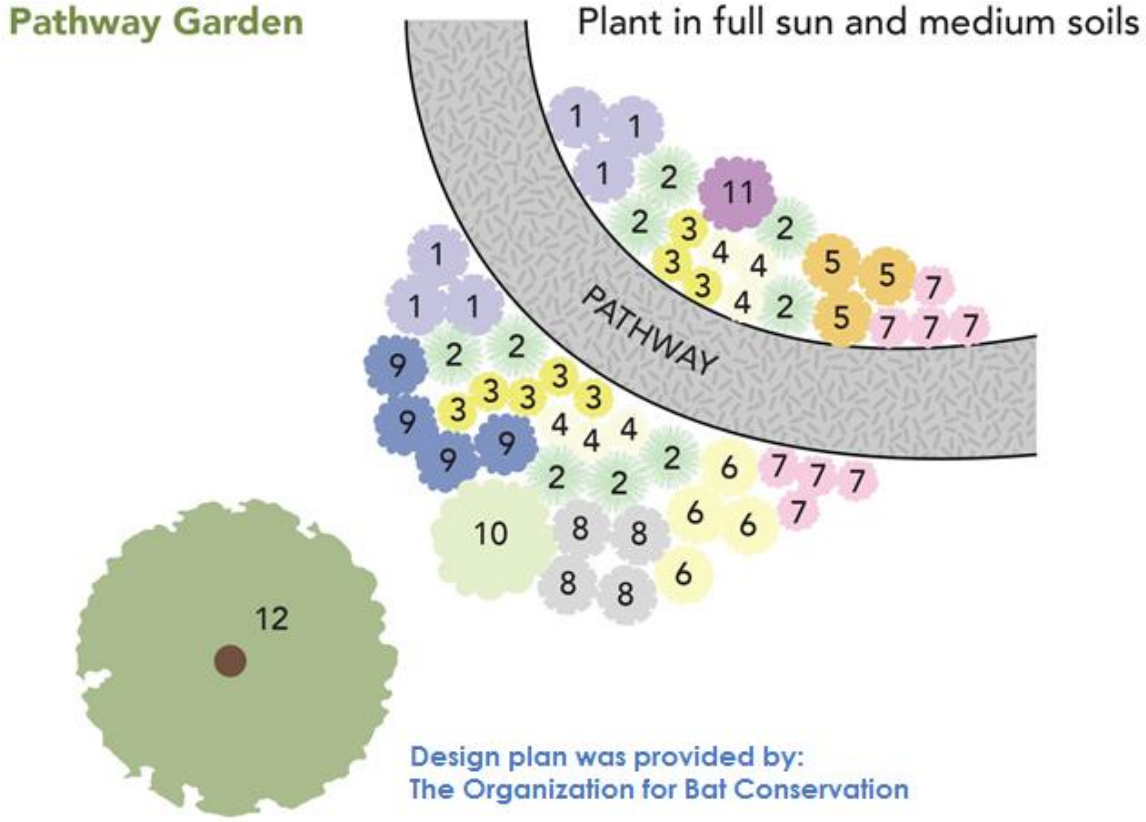
Gardens for Bats

Bats need more than just places to roost and water to drink. They also need a safe and reliable source of food. For insect-eating bats, you can create a garden that is a wonderful place for you, for bats, and other wildlife. Planting herbs and flowers that attract insects will bring bats to your yard and create an attractive garden. Pale flowers are a wonderful choice since they are easily seen in poor light and will attract night-flying insects. Examples of bat-friendly plants and shrubs include evening primrose, bergamot, goldenrods, asters, rosemary, lemon balm, lavender, New Jersey tea, common buttonbush, chives, and mints. Take care to choose plants that are native to your area and will thrive in the light and soil available at your site. Remember, native plants have evolved to attract native insects. And, once established, native plants will require less watering and weeding than non-native plants.

The Lady Bird Johnson Wildlife Center is a great resource with a well-researched database of both native plants and shrubs by state and by region. This will help you match your site-specific conditions to the right plants. And, don't worry, even small spaces will entice bats to your home if there's something good to eat. You can grow relatively short plants in pots on your deck or in a window box to provide a small patch of habitat for insects. We recommend that you use the largest containers that you can fit in your space. This is especially important if you want to grow perennials and overwinter them (you will need at least a 12" pot). Small raised beds also work well. By day, your garden will provide habitat for butterflies and hummingbirds, while at night, it will provide a smorgasbord for bats! Whether you have a couple of pots on an

apartment patio, a small city rooftop garden, or acres in the countryside, you can help bats.

Here is an example of a bat garden plan that was designed for the Upper Midwest by the Organization for Bat Conservation. The plan uses a variety of perennials to attract an abundance of moths and other insects. Moths are one of North American bats' favorite foods. Once established, these gardens will bloom through the growing season with minimal maintenance.



Pathway Garden Planting Key

Code	Common Name	*Latin Name*	Amt	On Center Spacing	Ht.
1	Bergamot	*Monarda fistulosa*	6	1.5'	4'
2	Palm Sedge	*Carex muskingumensis*	9	1.5'	3'
3	Prairie Sundrops	*Oenothera pilosella*	8	1'	2'
4	Smooth Penstemon	*Penstemon digitalis*	6	1'	2'
5	Stiff Goldenrod	*Solidago rigida*	3	1.5'	4'
6	Orange Coneflower	*Rudbeckia fulgida*	4	1.5'	3'
7	Prairie Phlox	*Phlox pilosa*	8	1'	1'
8	Virginia Mountain Mint	*Pycnanthemum virginianum*	4	1.5'	3'
9	Sky Blue Aster	*Aster oolentangiense*	4	1.5'	3'
10	New Jersey Tea	*Ceanothus americana*	1	3'	3'
11	Sweet Joe Pye	*Eupatorium purpureum*	1	2'	7'
12	Choke Cherry	*Prunus virginiana*	1	8'-10'	25'

Go Wild and Natural for Bats

To make your space even more attractive to bats, you can take a series of actions to provide a green and healthy environment. Keep your yard as natural and wild as possible. Allow some plants to grow as shelter for insects that can act as food for bats. Insects are a sign of a healthy garden and provide a food source for bats, birds, and other wildlife. Organic gardening is the way to go when you want to support both predator and prey.

Reduce or Eliminate Pesticide Use

Remember, you want insects to come to your garden, so don't use pesticides. Pesticides are chemicals used to control, destroy, or repel pests and include rodenticides, insecticides, herbicides, and fungicides. Pesticides can be very effective, but sometimes have unintended effects. Pesticides can bioaccumulate, meaning that small amounts consumed over time build up. An example would be if a bat eats 100 insects that have been covered with an insecticide, the bat has been exposed to the insecticide from all 100 of those insects. Over time, too much exposure can lead to illness or death. Excessive use of pesticide is both an environmental and human health issue.

To decrease pesticide use and reduce negative effects, try some of the following tips:

- Do not use pesticides unless absolutely necessary.
- Plant native species that are well-adapted to the area and, therefore, require less pesticide, fertilizer, and water.
- Research and try alternative pest control methods (like attracting bats).
- When possible, remove insect pests by hand if you have a small number of insects or wash them off with a stream of water from a hose.
- Provide diverse and natural habitats to attract native predators, such as ladybugs, soldier beetles, and tachinid flies.
- Use only organic or natural products/deterrents such as soap, garlic, and chili pepper.
- If you must spray, do so during the day when it's dry and there is no wind. Be sure to spray low to the ground. Bats are sensitive to synthetic pesticides.
- If you must use a pesticide, be careful to read the label and follow all directions.
- Buy organically grown products to discourage pesticide use worldwide.
- Support organizations dedicated to reducing dependence on pesticides.

Turn Off Your Lights

Lots of flying insects are attracted to lights at night. Are bats attracted to the lights, too, to feed on the insects? Bats are actually sensitive to artificial lights due to their nocturnal habits. Research shows that bat activity is generally lower in well-lit areas. Lighted zones might also cause bats to change their flight path between roosting and feeding areas, resulting in increased energy use by the bats. Many species of bats migrate in the spring and fall and there are well-documented cases of the deaths of migrating bats as they strike tall lit buildings.

What can you do? Turn off your lights at night! Be sure to consult with adults about lights that might be necessary for safety and security concerns. If lights are needed, replace outdoor lights with low glare lights. You can also ask an adult to make sure

outdoor lights point down toward the ground to avoid light leaking into the sky. Put outdoor lights on motion sensors and timers to reduce the time lights are on. Reducing light at night to help bats and to conserve energy, too!

Keep Your Cat Indoors

In places where White-Nose Syndrome occurs, every bat has become important. That means even small actions can become extremely important in making sure that bats that live in WNS-affected areas have the best chance of surviving. One simple thing that you can do to increase bat survival is to keep cats that you own inside at night. You can save bat lives by bringing your cat inside. This is especially important from June to September when bats are raising their young. Young bats are not very good flyers and they make an easy target for an outdoor cat.

Cat attacks are one of the most common causes of bat deaths in urban environments. Cats will learn the location of a bat roost and catch bats as they emerge at night. Normally, a cat will not eat the bat, but instead prefers to just play with the animal. It may be hard to believe that your pet would kill a bat or any other animal because of its sweet personality or because it is well fed. However, domestic cats have strong hunting instincts, and even well-fed cats can injury or kill bats (and other wildlife). A survey revealed that over 30% of bats that were rescued and taken to wildlife rehabilitators had been attacked by cats. And, over half of these bats did not survive the cat attack. Keep your cat safe and healthy and help bats too. Keep your cat indoors!

Resources for Research about Creating Bat-Friendly Habitats/Bat Gardens

Bat Habitat - http://www.batworlds.com/bat-habitat/

Free Guide to Bat Gardening – https://batconservation.org/help/bat-gardens/#section-Bathouse

Gardening for Bats - http://www.bats.org.uk/pages/encouraging_bats.html

Water for bats and other wildlife - https://www.batcon.org/pdfs/water/bciwaterforwildlife.pdf

Where Do Bats Live - http://www.bats.org.uk/pages/where_do_bats_live.html

Resources for Research about Turn Off Your Lights

Bats and Lighting Research Project – http://www.batsandlighting.co.uk/Research%20Areas.html

5 Ways You Can Reduce Light Pollution –

http://www.mnn.com/your-home/remodeling-design/stories/5-ways-you-can-reduce-light-pollution

Hiding from the Lights, Bats Magazine, Bat Conservation International -

http://www.batcon.org/component/batmag/bat_article/1076

Switch off the Lights for Bats, Science Daily -
https://www.sciencedaily.com/releases/2015/03/150316093005.htm

Resources for Research about Keeping Cats Indoors

Cat Attacks - http://www.bats.org.uk/pages/cat_attacks_on_bats_and_other_predators.html

Cats Indoors- https://abcbirds.org/program/cats-indoors/cats-and-birds/

Bat Squad Service Learning Project – Bat Chat - Spread the Word about the Importance of Bats

Although bats account for almost a quarter of all mammal species (there are more than 1,300 species of bats worldwide), bats are by far the least studied of all mammals. Bats occupy almost every habitat in the world eating tons of insects nightly, pollinating flowers, and dispersing seeds that grow new plants and even trees. So, why don't we know more about them?

Despite how important bats are to the environment, many people fear and even hate them – often based on myths, stories they have been told, or movies they have seen. In movies, television shows, comics, and the news, bats usually are portrayed as spooky, scary, or even dangerous. Have you ever seen a movie with a helpful bat?

While it is easy to get caught up in the mystery and fear that surround bats, the truth about bats is that they are fascinating animals that are vital for a healthy environment and economy. If we set superstitions and Hollywood notions aside, we'll find that we need bats, and bats need us--now more than ever.

Bats are in decline nearly everywhere they are found. Bat numbers in the United States and Canada have declined dramatically as a new disease, White-Nose Syndrome (WNS) has killed over six million bats in just six years. This disease is killing bats as they hibernate in caves and mines. And, the impact of WNS is frightening! Up to 99% of bats in some WNS-infected populations die within a few years. Little brown bats, once the most common bat in the northeastern United States, may be in danger of regional extinction within the next 15 years. Yet, WNS is just one of many threats that bat populations face. Other threats include habitat loss, pesticide use, wind energy development, oil and gas exploration, residential and industrial development, disturbance of hibernating bats, and improper eviction of bats from buildings. There is an urgent need to protect our bats!

That is why it is so important to share the importance of bats with others. By letting our friends and family know the truth about bats, we encourage them to support bat conservation and spread awareness. People have a hard time studying or protecting something that they do not feel connected to or that they do not appreciate. The key to helping our bats is educating people about the wonder of bats and getting them to take actions to help them.

By sharing your passion for bats, you can help make a difference for bats. We need to let everyone know how cool bats are! To get started, you will want to have a good understanding of how bats and humans are connected. How do we interact and depend on each other? You will also want to have a good understanding of the threats that are facing bats and what can be done to help them. Your Bat Squad Student Reading Pages and your K-W-H-L chart can give you some ideas. Select the topics that you want to really emphasize as a part of your project. You can educate people about bats' role in insect control, pollination of plants, and spreading of seeds. You could share information about the beauty and diversity of bats or their amazing echolocation abilities. You may want to focus on threats to bats such as White-Nose Syndrome or habitat destruction. The choice is yours!

Once you have decided the points you want to share with others, you can do a couple of the following:

- Make a field guide about bats in your area.
- Write a blog about the beauty and value of bats.
- Give a presentation on bats at a school function or at the meeting of a community organization (rotary clubs are always looking for presenters).
- Write a story for the school newspaper or local newspaper.
- Design a public service announcement for your local radio station (keep it short - 30 seconds should do!).
- Lead a bat walk in your neighborhood, at your school, or at a county park.
- Work with a boy or girl-scout troop to teach them about bats using lots of hands-on activities.
- Challenge your family to eat bat-supported snacks for a day. This could be foods that are pollinated by bats or foods that are protected from insects by bats.
- Dress like a bat for a day and tell everyone you meet about bats.
- Host a film screening at your school or a local community building. There are several great films about bats and White-Nose Syndrome that you could show.
- Start a club at school about bats - learn more about Team Chiroptera by reading about Bat Squad Member Oscar on the Project EduBat website or read about their work at: http://www.mercurynews.com/2016/01/26/interest-in-bats-takes-wing-on-monterey-peninsula/
- Create artwork such as paintings, drawings, cartoons, music, or dance that capture the wonder and beauty of our bats. Find a local theater or art gallery to display your work. The Get to Know Program hosts an online expressive arts contest for young people (19 years old or younger). Art work including fine art, photography, writing, music, and video can be entered into this free contest.

Resources for Research about the Importance of Bats and How to Spread the Word

Bat Artwork: Get to Know Project (Wild Neighbours Society) - http://www.get-to-know.org/

Bats and Food - http://www.batcon.org/resources/media-education/halloween/bats-and-food

Bats are Important - http://www.batcon.org/why-bats/bats-are/bats-are-important

Bats Role in Pollination - http://www.batworlds.com/bat-role-in-pollination/

Pollinators - http://www.fs.fed.us/wildflowers/ pollinators/animals/bats.shtml

Education Resources - Project EduBat – https://batslive.pwnet.org/edubat/curriculum.php

Kids Educating About Bats

Madison Mies – TedEx - http://tedxtalks.ted.com/video/You-Need-Bats-Bats-Need-You-Mad

Rachel Block – weekly blog for The Save Lucy Campaign - http://savelucythebat.org/blog/

Additional Resources for Presentations

Adorable Bat Animation Shorts – https://vimeo.com/batsarentscary

Great Photos from Merlin Tuttle's Bat Conservation – https://merlintuttle.smugmug.com/

Bat Squad Service Learning Project - Build and Install a Bat House

With declining habitats, bats need places to find food, shelter, space to raise their young, and water. Bats need a safe, warm place to rest and to raise their young during the summer. Most bats only have one baby a year and having a safe home is vital to long-term survival. Installing a backyard bat house is a great way to provide a home for bats. Bat houses are especially important in areas where there are few natural roosting sites such as large trees or caves. Consider placing a bat house in your backyard, at your school, or in a local park. Be sure to get permission before you begin building your bat house. And, check with local bat experts for proper placement and appropriate styles for your region.

Bats are amazing animals that are vital to the health of our environment and economy eating tons of insects nightly. Bats are our most important natural predators of night-flying insects, consuming mosquitoes, moths, beetles, crickets, leafhoppers, chinch bugs, and much more! Many of these insects are serious agricultural or forests pests, and others spread disease to humans or livestock. Every year bats save us billions of dollars in pest control by simply eating insects.

In temperate latitudes, like the United States, the bat species that are most likely to occupy a backyard bat house are insectivores that eat agricultural pests and some of the nasty bugs that harass outdoor gatherings (a.k.a. mosquitoes). Thanks to research conducted by Bat Conservation International, we know that 14 species of North American bats use bat houses, including threatened and endangered species. Building a bat house is a great way to attract and accommodate bats on your property. There are a variety of designs of bat houses, and you can either make your own or purchase one. Or, better yet, host a bat house building party and see how many homes you can build in a single day. If you are working with a community partner, perhaps you could even build a really big bat house – one that can handle thousands of bats!

Not all bat houses are the same. Based on over a decade of research, we know that the most successful bat houses have roost chambers at least 20 inches tall and at least 14 inches wide. The taller and wider the house, the better. Any bat house you build should have a 3- to 6-inch landing area below the entrance or a recessed partition with landing space inside. You can select a bat house that is single, double, or triple chambered. Although the number of roosting chambers is not critical, the more chambers the better. If you build a single-chambered house like the instructions below, be sure to mount it on a wooden or masonry building to help buffer changes in temperature.

A triple chamber bat house can make a home for up to 300 insect eating bats. Can you imagine how many insects those bats could eat? Think about this. A single colony of 150 big brown bats in Indiana can eat nearly 1.3 million insects that are pests to agriculture in a year. You could provide a home for up to twice that many bats! Building and then installing a bat house can make a difference for bats, help promote a healthy environment, and help farmers!

batcon.org
BAT CONSERVATION
INTERNATIONAL

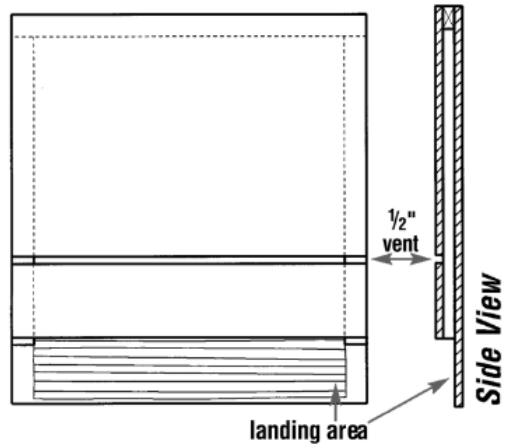
Single-chamber Bat House (wall mounted)

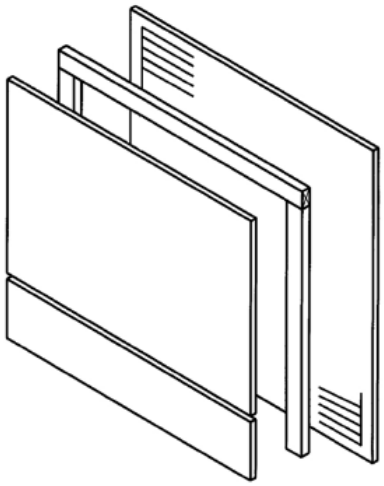
Materials (makes one house)

¼ sheet (2' x 4') ½" AC, BC or T1-11 (outdoor grade) plywood
One piece 1" x 2" (¾" x 1½" finished) x 8' pine (furring strip)
20 to 30 exterior-grade screws, 1"
One pint dark, water-based stain, exterior grade
One pint water-based primer, exterior grade
One quart flat, water-based paint or stain, exterior grade
One tube paintable latex caulk
1" x 4" x 28" board for roof (optional, but highly recommended)
Black asphalt shingles or galvanized metal (optional)
6 to10 roofing nails, ⅞" (if using shingles or metal roofing)

Recommended tools

Table saw or handsaw	Caulking gun
Variable-speed reversing drill	Paintbrushes
Screwdriver bit for drill	Hammer (optional)
Tape measure or yardstick	Tin snips (optional)





More bat-house plans and additional information can be found in BCI's *Bat House Builder's Handbook*, available at *www.batcatalog.com*.

Construction

1. Measure and cut plywood into three pieces:
   26½" x 24" 16½" x 24" 5" x 24"
2. Roughen inside of backboard and landing area by cutting horizontal grooves with sharp object or saw. Space grooves ¼" to ½" apart, cutting 1/32" to 1/16" deep.
3. Apply two coats of dark, water-based stain to interior surfaces. Do not use paint, as it will fill grooves.
4. Cut furring strip into one 24" and two 20½" pieces.
5. Attach furring strips to back, caulking first. Start with 24" piece at top. Roost chamber spacing is ¾".
6. Attach front to furring strips, top piece first (caulk first). Leave ½" vent space between top and bottom front pieces.
7. Caulk all outside joints to further seal roost chamber.
8. Attach a 1" x 4" x 28" board to the top as a roof (optional, but highly recommended).
9. Apply three coats of paint or stain to the exterior (use primer for first coat).
10. Cover roof with shingles or galvanized metal (optional).
11. Mount on building (south or east sides usually best).

Optional modifications to the single-chamber bat house

1. Wider bat houses can be built for larger colonies. Be sure to adjust dimensions for back and front pieces and ceiling strip. A ¾" support spacer may be needed in the center of the roosting chamber for bat houses over 24" wide to prevent warping.
2. To make a taller version for additional temperature diversity, use these modifications: From a 2' x 8' piece of plywood, cut three pieces: 51" x 24", 33" x 24" and 12" x 24". Cut two 8' furring strips into one 24" and two 44" pieces. Follow assembly procedure above.
3. Two bat houses can be placed back-to-back, mounted between two poles, to create a three-chamber nursery house. Before assembly, cut a horizontal ¾" slot in the back of each house about 9" from the bottom edge of the back piece to permit movement of bats between houses. Two pieces of wood, 1" x 4" x 4¼", screwed horizontally to each side, will join the two boxes. Leave a ¾" space between the two houses, and roughen the wood surfaces or cover the back of each with plastic mesh (see item 5 below). Do not cover the rear exit slots with mesh. One 1" x 4" x 34" vertical piece, attached to each side over the horizontal pieces, blocks light but allows bats and air to enter. A galvanized metal roof, covering both houses, protects the center roosting area from rain. Eaves should be about 3" in southern areas and about 1½" in the north.
4. Ventilation may not be necessary in cold climates. In this case, the front should be a single piece 23" long. Smaller bat houses like this one will be less successful in cool climates. However, those mounted on buildings maintain thermal stability better and are more likely to attract bats.
5. Durable plastic mesh can be substituted to provide footholds for bats. Attach one 20" x 24½" piece to backboard after staining interior, but prior to assembly.

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Choosing a good area to install your bat house is just as important as how you build it. Many bats that colonize bat houses are very temperature specific when it comes to roosting because they need an area warm enough to raise their young. Bat houses should be placed in an area that receives at least 6 hours of direct sunlight in states with an average summer high of 100ºF or less. In states with an average summer high of 80ºF or less, the house should be placed in an area where it can get as much direct sunlight as possible. Painting the house also helps with temperature control, as well as protecting the house against weathering. What color and how dark you should paint your bat house depends on where you live. Learn more at the websites below.

Your bat house can be mounted on wooden posts, steel or pivot poles, or on the side of a building. You should NOT mount your bat house on a tree. In general, you should place your bat house 12 to 20 feet above the ground.

Bats will need time to find and explore new homes, so it may take a few years before your bat house has residents. Once they arrive, you can start a monitoring program to count bats. You will enjoy learning more about bats as you watch them come and go from the home you provided. You can even collect real-world data about bat populations. The Wisconsin Department of Natural Resources has great information about their program and this could easily be modified for your home or schoolyard.

Resources for Research about Build and Install a Bat House

Bat Conservation International -
http://www.batcon.org/index.php/resources/getting-involved/install-a-bat-house

Bat Week – Build a Bat House
http://www.batweek.org/index.php/past-events/build-a-bathouse-2015/how-to-make-a-bat-house

Bat Week – Install a Bat House
http://www.batweek.org/index.php/past-events/build-a-bathouse-2015/how-to-install-a-bat-house

Organization for Bat Conservation -
http://www.batconservation.org/bat-houses/build-your-own-bat-house

Wisconsin Department of Natural Resources -
http://dnr.wi.gov/topic/wildlifehabitat/bathouse.html

Bat Squad Service Learning Project - Write a Letter to Your Local, State, and National Representatives

Letting state or local officials know that you care about bat conservation can lead to projects and policies that better protect bats and draw attention to how important and threatened they are.

In your letter, try to demonstrate how bats are important to the environment, to our food, to our economy, and to our overall health. Clearly state what the goal of your letter is and make sure that it is reasonable. For example: "Bats eat insect pests, which eat our crops and present a human health hazard. Please support funding to create a greenway in our town that will attract bats and other wildlife."

Considerations for writing an effective letter to a representative include:

Who will receive your letter?

- You will need the name, title, and address of the official who can take action on your issue. Be sure to correctly copy names and addresses (see "How to contact elected officials" in "Resources" below).

Is spelling important?

- Yes! Be sure to review your letter for proper grammar and spelling.

Begin your letter respectfully.

- Use the person's official title and their full name.

What is the purpose of your letter?

- Your first sentence should tell the official what you are concerned about.

What do you want the official to know?

- Summarize what you know about the issue.

What can the official do to make a change?

- Be specific! Describe what the official can do to make a change.

Who will be affected by this change?

- Describe specifically the positive or negative effects the action will have. Use statistics to show how bats and people will be affected.

Close and sign your letter

- Thank the official and sign your full name in ink. Include your address, email, and phone number.

Important Tips

- Always take the time to check your letter for correct spelling and grammar.
- Always be polite!
- For feedback on your letter's effectiveness, ask a classmate and a teacher to read your letter.
- If possible, encourage others to also submit a letter on this same topic. Be sure that they write their own letter and do not just copy what you have written. Studies have shown that personalized communication has a far greater impact than a form letter or a petition. Everyone has a different way of expressing

themselves and showing those differences is important when it comes to writing a letter.

- Keep your letter short and focused on one issue.
- Personal stories of how you, people you know, or people you have spoken with are affected by this issue will add to the effectiveness of your communications.
- Be sure to include a specific task. You are more likely to make an impact and be successful if you make a specific request rather than just express a general request.
- Messages that attempt to persuade, rather than demand, are more likely to be heard.

The Power of Words - Successful Letter Writing Campaign

Students at the Gertrude Burns Elementary School in Newcastle, Wyoming, successfully persuaded the Wyoming State Legislature to name the Eastern short-horned lizard (*Phyrnosoma douglassii*) as the official state reptile. Habitat destruction and people killing ants (an important part of the lizard's diet) had placed several species of horned lizards in danger. Also, people often remove lizards from their natural habitat and try to keep them as pets. Taken from their native surroundings and offered an improper diet and an inadequate place to live, horned lizards often die.

The students conducted extensive research, drafted a bill for the legislature, and testified before the House Travel, Recreation, and Wildlife Committee. One key element of their successful project was a letter and petition writing campaign, including sending letters and petitions to every school in Wyoming!

Great advice and specific ideas for writing an effective letter can be found in "Writing Letters to Elected Officials" from the Community Toolbox (see "Resources" below).

Resources for Research about Write a Letter to Your Local, State, and National Representatives

How to contact your elected officials - https://www.usa.gov/elected-officials

University of Kansas, Work Group for Community Health and Development. (2015). Chapter 33, Section 1: Writing Letters to Elected Officials. Lawrence, KS: University of Kansas. Retrieved August 4, 2106, from the Community Tool Box: http://ctb.ku.edu/en/table-of-contents/advocacy/direct-action/letters-to-elected-officials/main

Bat Squad Service Learning Project - Volunteer!

Creating your own Bat Squad project from scratch might seem more than a little daunting. If you are having a hard time coming up with a project on your own, perhaps you should consider joining an existing project. You can volunteer! There are so many amazing organizations and people that have dedicated themselves to helping bats, and they all welcome volunteers.

What does it mean to volunteer? What is the value of volunteering? And, why should you consider becoming a volunteer? Becoming a volunteer is about giving, contributing, and helping other individuals and your community. By volunteering for a bat conservation or other natural resource organization, you can work with others to make a meaningful contribution to improve your community and the environment. While you will not get paid for these contributions, the value of volunteering is much deeper, much more fulfilling, and much more important than money can ever measure. As Albert Einstein said, “Not everything that counts can be counted. And not everything that can be counted, counts.”

You can volunteer for a variety of reasons. Some people want to gain experience for future jobs, acquire new skills, or to meet new people. Others want to give back to their community, help a friend, or promote a worthwhile cause. Volunteers working to protect bats and the environment may gain a deeper knowledge about the natural resources around them, collect valuable data that leads to decisions to protect the resources they love, and more. It is important to remember that volunteer opportunities are rich and diverse. You can volunteer for a one-day tree planting activity or volunteer to help organize a large event like a bat festival. These large and small acts, given freely, have the power to change the community and the world.

Project Ideas and Volunteer Opportunities

Bat Festival: Many states and local parks host annual bat festivals to celebrate the unique roles that bats play in our world. These events often include live bat programs, bat house building, techniques that can be used in backyards to help bats and the environment, and other hands-on activities. And, they often need help! You could volunteer to host an activity, help staff a registration booth, give a talk about bats, or anything else you can think of that will aid the event. Alabama, Florida, Indiana, Michigan, Wisconsin, Texas, and Virginia are a few of the states that host Bat Festivals. If there isn’t a bat festival near you, perhaps you could help establish one!

Bat Week: This is an annual celebration dedicated to sharing the importance of those flying, furry mammals we love—and need—so much. Bat Week is typically held the week of Halloween. Many times, bats are portrayed around this time of year in a negative and scary way. Bat Week seeks to turn that negative image around by focusing on the importance of our bats and why we need them. Each year, Bat Week has a particular type of project that they encourage people around the world to accomplish such as bat house building or pulling non-native invasive species. If you can’t participate in the main project, there are lots of other ways to be involved. You could give an educational presentation at a local school to get kids interested in bats, throw a Bat Week party at your local library or visitors center, host an outdoor event for

families such as a Fall night hike—or anything that will help spread the word about bats. Be creative! Get involved! Be a bat champion! Learn more at http://www.batweek.org

Bat tracking: Participate in North American Bat Tracker. Document your bat sightings. Provide a picture of the bat and/or a picture of the habitat you see bats using. Provide the location and time. Note the weather conditions. Note what the bats are doing, i.e., hunting over open meadow, flying under tree canopy, hanging on a window screen, drinking from a pond, etc. Note how many bats you see in one setting. Contact Project Noah to become involved in this project at http://www.projectnoah.org/missions/18306114

Blog or Social Media: Many organizations are doing what they can to restore or provide habitat for bats, to care for injured bats, and even researching treatments for White-Nose Syndrome. They may not have time to focus on getting the word out about the importance of bats or the work that they are doing. You could help. Consider contacting an organization that you respect and asking if they need help with social media. You might be surprised how happy they are to hear from you.

Conduct acoustic surveys: The Wisconsin Department of Natural Resources Bat Program has trained hundreds of volunteers to collect bat acoustic data and has run over 2,600 acoustic survey routes. Volunteers monitor summer bat roosts at over 75 locations statewide. The Bat Program has catalogued and monitored 150 known cave and mine hibernation sites. Many states across the country have similar programs. Call the Department of Natural Resources in your state to find out how you can help the bat populations near you.

Other ideas: Review the websites below and look for opportunities to volunteer with these organizations on bat conservation and bat education projects.

Resources for Research about Volunteering

Federal Volunteer Opportunities - https://www.volunteer.gov/

U.S. Forest Service (USFS) - http://www.fs.fed.us/working-with-us/volunteers

U.S. Fish & Wildlife Service (USFWS) - https://www.fws.gov/volunteers/

National Park Service - https://www.nps.gov/gettinginvolved/volunteer/index.htm

Go local! Support your state parks and local parks. To find a park near you, go to: http://www.discovertheforest.org/?m=1#map

Bat Conservation International - www.batcon.org

Organization for Bat Conservation - https://batconservation.org/organization/volunteer/

The Save Lucy Campaign - www.savelucythebat.org

Project Noah - http://www.projectnoah.org/missions/18306114

Lubee Bat Conservancy - www.lubee.org

Wisconsin Department of Natural Resources Bat Program - wiatri.net/inventory/bats

Bat Project, New Jersey - http://www.conservewildlifenj.org/protecting/projects/bat/

Bat Squad Service Learning Project - Fundraise for Bats

Bat conservation activities need lots of volunteer time and effort. But, sometimes researchers and organizations need money to do conservation work and to conduct research. How can you help? You could host an event to help raise much needed funds for bats.

Be sure to identify where you would like your funds to go first. Carefully consider the organization or researcher you would like to receive your fundraising proceeds. Do they have a history of success in bat conservation and/or research? Do they accept funds from individuals and schools? Do you want to support an organization that is restoring habitat for bats, one that is conducting research on White-Nose Syndrome, one that is helping to educate people about the importance of bats, or one that takes in injured or orphaned bats? Once you have selected the organization that you want to support, you can select a fundraiser.

Fundraising ideas

Here are suggestions for how you can fundraise for bats:

- Host a school dance, Halloween party, trivia night, or other special event. The money raised from admission and snacks could be donated to a bat conservation organization. You could also charge a small fee for games, a costume contest, raffle for prizes, face painting, etc. See our event guide for helpful suggestions and tips to make any event a huge success on the Project EduBat website at: https://batslive.pwnet.org/edubat/curriculum.php. The guide is found under "The Bat Squad!" activity.
- Create a play about bats and perform it at your school. It could be about the threats facing real bats or just a fun play that stars a cast of bat characters. Be sure to sell tickets and snacks. Put out a donation jar and ask your audience to donate any change they have with them.
- Host a bake sale for bats – make bat shaped cookies, guano snacks, bat puffs, or anything else you can think of. See our Project EduBat snack guide to get your creative juices flowing at the website listed above.
- Create beautiful bat art and host an auction. You can host a live auction or a silent auction. A live auction will have a real-life auctioneer and only people who are at the event will be able to place a bid. On the other hand, a silent auction is held without an auctioneer. People place their bids on sheets of paper instead. During a typical silent auction event, items for auction are displayed for participants to inspect closely. In front of each item is a document called a "bid sheet" (go to the Project EduBat website for a bid sheet template that you can modify). Your auction can either be the main attraction around which an entire event is based, or it can be an extra form of entertainment (and fundraising) as part of an awards ceremony, dinner, meeting, etc. Remember, people bid for two very important reasons: 1) they want to support the cause, and 2) they have a desire for the item being offered.

- Host a concert with your friends, school choir, or school band. You can sing or play any type of music that you like. Perform a few songs that the crowd can sing-a-long with too. And, having at least one bat-themed song would be a great touch. Be sure to sell tickets and snacks. Do you know a lot of musically talented people? Why not host a "Battle of the Bands?" You can raise funds from band entry registration fees, ticket sales, and crowdfunding donations raised by the fans as they cast votes for their favorite bands.
- Participate in a 5K or other running/walking event; ask people to sponsor your run for bats. Need some inspiration? Look up Batty the Clown, an avid marathon runner with a passion for bat conservation. Every year, Batty runs over 50 miles to raise funds for bat conservation.
- Talk to local restaurants, yogurt shops, bookstores, movie theaters, etc. about hosting a fundraiser in which a certain percentage of sales on a given day go towards bat conservation. Find a local business that benefits from bats such as health food stores, farmers, etc.
- Design and create unique bat houses that could be sold to raise money for bat conservation. You could use interesting materials to make the bat houses or paint them with beautiful illustrations.
- Host an event where you will provide goods or services for a donation such as a car wash, dog wash, garage sale, book sale, or any other kind of sale. This is a great way to get a group of friends involved in your efforts.
- Work with your school to host a "dress batty day." Students and teachers who pay a dollar are allowed to wear their best batty garb. This is a fun way to raise awareness and funds!
- Shave your head for bats! Set a fundraising goal and promise to shave your head if you raise the amount. Perhaps offer the person who donates the largest amount of money the chance to remove the first patch of hair. Make sure you have your parent or guardian's approval before doing this!
- Do you love to dance? Then it might be time to hit the dance floor and throw some shapes! Putting on a 12-hour dance-a-thon offers a fun and straightforward way of raising money for bat conservation. Get a group of willing classmates to sign up (either individually or as couples) then encourage them to get pledges from friends, relatives, and neighbors. You can accept flat fee pledges or let people pledge an amount per hour. A good place to start is $2 to $5 for every hour a contestant or partner lasts on the dance floor. Make sure your dancers have enough time before the event to collect plenty of donations from those in their nearby community.

  Select a great venue with enough space for all of your dancers to strut their stuff — something like a community center or a school gym will work well. Make sure there are beverages and light snacks on sale to keep the dancers (and spectators) going. To make the most out of your Dance-a-Thon, promote "Shout-Outs" for a dollar. A shout out is a message that is ready by the DJ or Emcee to

the audience in between dance songs. For instance, “This is a Shout Out from Taylor to all his football friends. Bats Rule!” You will need to have slips of cardstock pre-printed so the “Shout Outs” can easily be submitted.

- Create a t-shirt for bats! Everyone, regardless of their age or gender, wears t-shirts. So, offering a cool design on a t-shirt can be a fantastic fundraiser idea because it is a product that everybody uses. Use your own original artwork or work with a friend to create a unique shirt. You could even have an interesting bat fact on the back of the shirt.
- Be creative! Your own fundraising idea might be the best solution.

Managing money

When you manage donated money, you need to have good accounting practices and to keep the money secure. Ask at least two adults to assist you in managing the money from your fundraiser. All the money that you collect that isn’t spent on expenses for the event should be donated.

Publicize your success

Your donors will want to hear how much money you raised and how the money was used to help bats. You can share your success with them through email, a blog post, or a website. Contact your local news outlets (radio, newspaper, television) to share your fundraising success with your community. You can download a sample media release on our website at https://batslive.pwnet.org/edubat/curriculum.php under “The Bat Squad” activity.

Here are a few organizations that Project EduBat works with that you might consider in your fundraising efforts:

Bat Conservation Organizations and White-Nose Research Funds

Bat Conservation International - http://www.batcon.org/our-work/initiatives/award-grants-scholarships

Organization for Bat Conservation - www.batconservation.org

National Speleological Society, White-Nose Syndrome Rapid Response Fund - http://caves.org/WNS/Rapid_Response.shtml

Bat Rehabilitation Organizations

The Save Lucy Campaign - http://savelucythebat.org/

Bat World Sanctuary - https://batworld.org/

The Wisconsin Humane Society's Wildlife Rehabilitation Center at the Milwaukee Campus - http://www.wihumane.org/wildlife

Bat Squad Service Learning Project - Dedicate Your Science Fair Project to Bats

It's that time of year again – time to choose a science fair project! You always have so many possibilities. How about dedicating your science fair project to bats? Your project could increase the awareness of the importance of bats and the need to help them. Also, you never know what important discovery you might make that could benefit humans.

Bats are important to us in so many ways including providing natural insect control, pollinating plants, and spreading seeds to make new forests. Yet, there is still more to consider regarding the roles that bats play in our world. Bats also play a significant role in ways that you might not normally think about such as contributing to science and medicine. Research conducted on bats has led to advancements in sonar, vaccine development, blood anti-coagulation, and more. For example, scientists used enzymes taken from vampire bat saliva to develop a blood-clot dissolving drug called Draculin. Draculin is now being studied for the treatment of strokes and heart attacks!

Bat echolocation has been used in many ways in the medical field. Using sound waves to produce pictures of the inside of the body, doctors are able to allow pregnant women to examine their unborn babies. These ultrasound images were developed by studying echolocation. Echolocation was also used extensively in the development of the most technologically advanced aircraft such as the B-2 Stealth Bomber and has been adopted for use in submarine navigation. There are even experiments being conducted to develop echolocation as a strategy to help blind people 'see.' Who knows what other important findings we will discover as we continue to study bats?

And, there is so much that we still don't know about our bats. A science fair project is a great opportunity to learn more. Studying the habits of bats, the places where they live, the foods they eat, and the threats that they face could lead to important discoveries that could greatly help our bats. You could be the scientist that makes that discovery!

All you need to do is choose a scientific question that you would like to answer about bats. Then, conduct library and Internet research to get the background information you will need to formulate a hypothesis and design an experiment. You could detect flying bats by analyzing their ultrasonic sounds using a bat detector like Bat Squad member Alexis Valentine. Alexis has been conducting her own research in the Great Smoky Mountains for over three years. She wanted to determine the effects of White-Nose Syndrome on bats using the area. She has placed very highly in multiple science fairs by sharing the results of her research. She has even been able to meet famous bat scientists like Merlin Tuttle because of her efforts.

Science fairs are really important for a number of reasons and there are some great benefits to participating and placing in these events. Here are just a few:

- By competing at the county, state, and national levels you could win great prizes and even college scholarships!
- Your science fair project could help you get into a college or university of your choice! Science fair honors rank high among the screening factors used by top universities for admitting students.

- Science fair projects are evaluated by top local scientists from research and industry. Who knows who you might meet!

A safety note: For your science fair project (and at any other time!), please do not touch or handle bats. A bat that is easily approached by humans may be injured or sick and the bat might bite if you attempt to handle it. Simply do not handle or approach bats, any other wild animal, or domestic animals that are acting strangely to eliminate most risks of being bitten. If you do find an animal that appears to be a potential threat or is in trouble, call a wildlife professional.

Resources for Research about Dedicate Your Science Fair Project to Bats

A Little Science Party - https://www.youtube.com/watch?v=uYwfoepBPUM

Bat Detector: Listen to the Secret Sounds of Bats - http://www.sciencebuddies.org/science-fair-projects/project_ideas/MamBio_p024.shtml

Discovery Education: Science Fair Central - http://school.discoveryeducation.com/sciencefaircentral/

Super Science Fair Projects - http://www.super-science-fair-projects.com/

Scientific American: 3 Strategies for an Original Science Fair Project - http://blogs.scientificamerican.com/guest-blog/3-strategies-for-an-original-science-fair-project/

Which bat ears hear the best? -http://anytimescience.com/bat-ears-science-fair-project/

Bat Squad Service Learning Project - Pull for Bats – Remove Non-native Invasive Plants

Non-native species are plants, animals, fungi, and other organisms that have been brought to a new area from some other place. Most non-native species do not become invasive. In fact, many that people rely on—corn, wheat, and rice—are not invasive. However, some non-natives establish themselves in a new area very quickly because they have no natural predators. They invade and take over the natural territory of other plants and animals, often crowding them out.

These pests can harm the economy, environment, or human health. Some invasive plants are even poisonous to insects and our trees. Invasive species have contributed to the decline of almost one half of all the species that are federally listed as endangered or threatened in the U.S. including several bat species. In fact, the fungus that causes White-Nose Syndrome is a non-native invasive species.

Non-native plants have been introduced for erosion control, showy flowers for gardens, food crops for livestock, use as medicine, and even to provide food for wildlife. They have also been introduced simply by accident. Most of these species never stray far from where they are introduced (gardens, urban areas, farms), yet some become very invasive and displace native plants in woodlands, wetlands, and other natural areas.

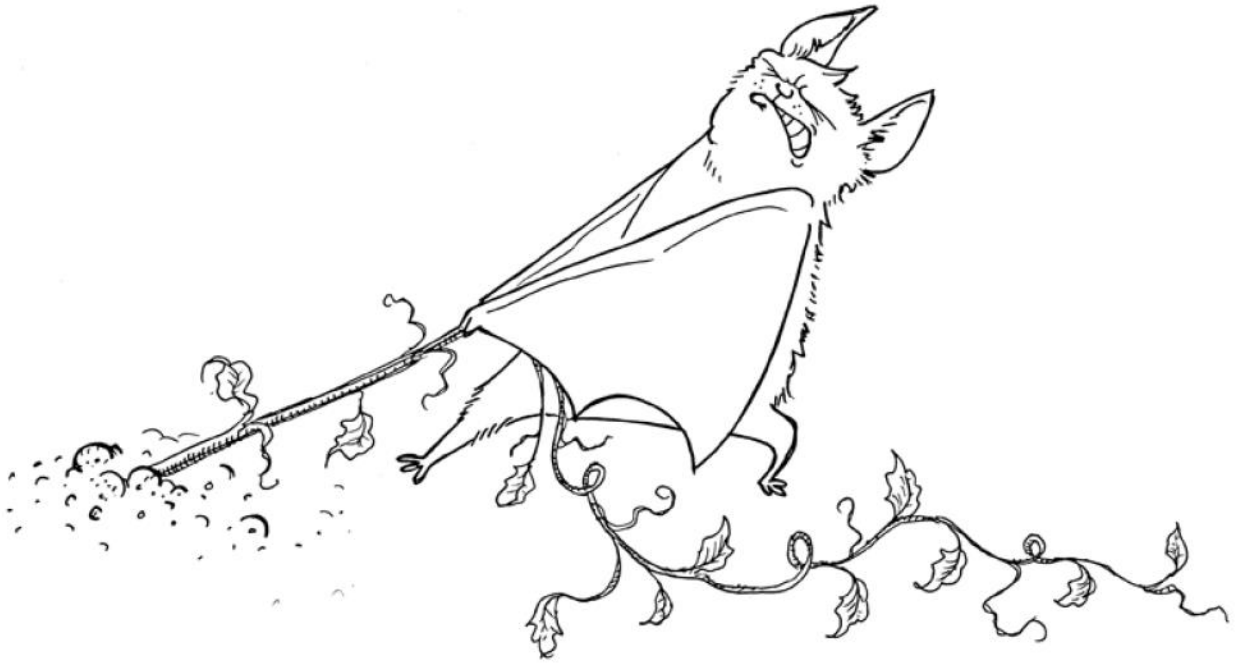
Many plants considered non-native are beautiful and can look lovely growing in your yard. Yet, it is important to look beyond these traits to see how these plants "act" in the wild. Sometimes we plant invasive non-native plants for landscaping or to provide wildlife habitat without realizing the problems they may cause when they escape into natural areas. Invasive plants are generally very difficult to control, can escape from yards, and can dominate whole areas.

Bats need to eat lots of different insects to stay healthy. When invasive plants move in, they push out our native plants. Native plants support a huge variety of yummy insects; invasive plants don't. Research shows that native plants do a better job of hosting and supporting local insect communities than non-native plants. By helping to remove invasive plants, you can provide a healthier environment and better food for bats and other wildlife.

Because invasive plants spread so quickly, it can take an army of volunteers to help get rid of these species. Get a group of friends together and join an existing event or you can even host your own! Go local! Support your state parks and local parks. To find a park near you, go the "Discover the Forest!" website at: http://www.discovertheforest.org/?m=1%20-%20map.

If you create your own event, you need to consider how you will recruit people to help, what tools will make plant removal easier, how to identify the non-native plants, and how you will dispose of the plants. If you want to host an event at a public location like a state or county park, you will need to contact the site managers before organizing a pull. Parks often have strict rules about removing plants and other objects that you will need to learn about. They will also have information about the best spots to pull invasive plants. To get you started, we are providing a list of plants that you might want

to consider pulling. These plants are a huge threat to our environment, can be removed by hand pulling or with small hand tools, and are easy to identify.



Suggested Invasive Plants of the Northeastern United States
Bush Honeysuckles (*Lonicera fragrantissima*)
Garlic Mustard (*Alliaria petiolate*
Japanese Barberry (*Berberis thunbergii*)
Mile-a-Minute (*Persicaria perfoliata*)
Reed Canary Grass (*Phalaris arundinacea*)
Common Burdock (*Arctium minus*)

Suggested Invasive Plants of the Southeastern United States
Chinese/European Privet (*Ligustrum sinense*)
English Ivy (*Hedera helix*)
Garlic Mustard (*Alliaria petiolate*)
Kudzu – (*Pueraria montana*)
Oriental Bittersweet (*Celastrus orbiulatus*)
Common Burdock (*Arctium minus*)

Suggested Invasive Plants of the Western United States
Chinese/European Privet (*Ligustrum sinense*)
English Ivy (*Hedera helix*)
Fountain Grass (*Pennisetum setaceum*)
Garlic mustard (*Alliaria petiolate*)
Houndstongue (*Cynoglossum officinale*)
Kudzu – (*Pueraria montana*)
Spotted Knapweed (*Centaurea stoebe*)
Common Burdock (*Arctium minus*)

Downloadable fact sheets are available for each of these invasive plant species at http://www.batweek.org/index.php/find-an-event/about. You can use these posters to help spread the word about the need to remove the selected plant(s) from yards, gardens, and natural areas.

When you have finished your pulling event, be sure to share your successful project through email, a blog post, or a website. Contact your local news outlets (radio, newspaper, television) to share your "Pulling for Bats" success with your community.

Other Ways to Get Involved:

- Check to see if a plant is invasive before planting it. Do not use invasive species in your garden.
- Learn to identify the major invasive plants in your area and watch for them. The sooner you spot an invasive plant, the easier and cheaper it will be to remove it.
- Be sure to clean your shoes and brush off your clothes after being in an area with invasive plants. Don't spread invasive plants or seeds!
- Remove all visible plants, plant parts, and mud from your boat or fishing equipment before leaving a waterbody. Don't spread invasive plants!
- Talk to local groups, communities, or government officials about invasive plants.
- Spread the word that invasive plants are a threat to our farms, woods, streams, prairies, wetlands, and of course, bats.

Resources for Research about Pull for Bats – Remove Non-native Invasive Plants

Garlic Mustard Video with Petersburg Elementary School - https://www.youtube.com/watch?v=J5FHSu_uOjE&feature=youtu.be

Midwest Invasive Plant Network - http://www.mipn.org/

Tucker the Turtle- Children's Invasive Plant Field Guide – http://bugwoodcloud.org/mura/phcwpma/assets/File/tucker/Tuckers_NNIS_Kids_Field_Guide_Feb262015.pdf

Why Should You Care About Invasive Species? Video - https://www.youtube.com/watch?v=MVWGkn6CYkE&feature=youtu.be

Planning Your Bat Squad Service Learning Project

1. What problem or threat will your project focus on?

2. What is the goal of your project?

3. Describe what you will accomplish with your project. Be sure to state any specific objectives that will help you reach your goal.

4. Create a timeline. List all of the tasks that you will need to accomplish to meet your goal. Use the table below to list the task, person responsible, date for completion, any supplies needed, estimated cost of supplies, and ideas of where you might get supplies or funding (if needed).

Task To Complete:	Due Date:	Person Responsible:	Supplies Needed:	Estimated Cost:	People, Places, or Ways to Cover Expense(s):

5. Ask for Help. Make a list of any person, business, or organization that may be able to provide you with useful information, special skills, expertise, or other assistance. For example, if you are building bat houses, perhaps a company that sells wood or construction supplies would want to provide assistance for your project.

6. Find Supporters! Make a list of people, businesses, or organizations that might be interested in your project. If you are creating a bat garden, perhaps a garden club or native plant society would want to provide plants for your project or help advertise the garden when it is complete.

7. Research. Be sure to conduct any additional research needed to help you learn more about your topic or to help you design your project.

8. Outline Potential Problems. Try to consider any issues that might make it difficult for you to complete your project. For example, if you are creating a bat garden, finding a suitable place for the garden and arranging transportation of students and materials to the garden might be obstacles.

9. Find Solutions. If you identified a potential problem, try to brainstorm ways that you could solve the problem. Having a plan in mind will help you move forward with your project as issues arise. For the example given in #8, could the school provide a bus for field trips to the garden site? Are there parents that could drive students and haul materials?

10. Spread the Word. Make a list of the different ways you will publicize and gain support for your project such as social media, website development, newspaper articles, podcasts, etc. Be creative.

11. Take Action! After all of your great planning, it is finally time to implement your project. Use this worksheet to help you successfully implement your project.

12. Reflect. Take time with your team to think about your project and all the effort that you put into completing it. Answer the following questions in the "L" Section of your K-W-H-L Chart to record what you have learned. How did your efforts support bat conservation and provide a benefit to your school or community? Were you satisfied with your results? If you had more time or more funding, what else might you have accomplished? What did you learn while completing your project? What did this service learning experience teach you about your role as a citizen in the community?

13. Celebrate! You did it! You helped make a difference for bats. Now it is time to celebrate and tell others about your success. You can post photos and share your insights about bats and the value of making a difference in your school or community on the Project EduBat Facebook page at: https://www.facebook.com/ProjectEduBat. Pictures or artwork that was created as a part of your project would make great posts and could inspire other students around the world to take action.

You can also become an official member of the "Bat Squad!" Work with your teacher to submit copies of your completed "Planning Your Bat Squad Service Learning Project" and "Assessing Your Bat Squad" worksheets along with other paperwork. You will receive a Bat Squad Member patch to display proudly. And, extraordinary projects will be included in updated versions of this Bat Squad Activity.

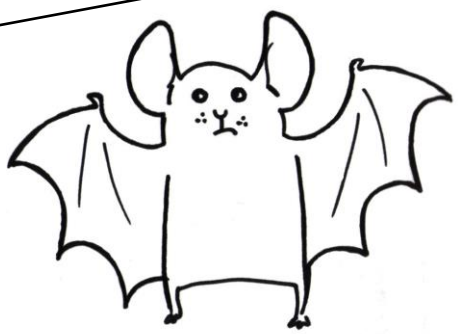
Assessing Your Bat Squad Service Learning Project

Resources to help you answer these questions include your Planning Your Bat Squad Service Learning Project pages, your journal, and your photo log.

1. What was the goal of your project? What were its objectives?

2. Did you accomplish your goals and objectives? Did you accomplish other outcomes you weren't expecting?

Did you notice the adorable art work on these pages? These were all created by a volunteer (except the Bat Squad logo)! Kim O'Keefe is a volunteer with The Save Lucy Campaign. You could volunteer your time and art work too!



3. What did you learn about the community/environment issue you addressed through your service?

4. How did your efforts provide a benefit to the community, environment, and/or bats?

5. How did you get the word out about your project?

6. What advice would you give to other students who are planning a Service Learning project?

TAKE ACTION FOR BATS!

Make a pledge and support a cause that's important to you. You can start in your own backyard, neighborhood, or community. Simply sign the pledge below and start taking action now! Once you take the pledge, be sure to cut it out on the dotted lines and put it somewhere that you and your family can see it every day.

BAT SQUAD PLEDGE CARD

I, _____, pledge to take the following actions to help conserve bats and their habitats: (Check at least three actions you will take including your service learning project)

__ Create bat-friendly habitat

__ Fundraise for Bats

__ Keep pets (especially cats) indoors

__ Build and install a bat house (batweek.org has free plans)

__ Write a letter to my local, state, and/or national representative(s)

__ Spread the word about the importance of bats to at least one other person and get them to sign a pledge card, too.

__ Learn more about fascinating bats, the benefits of bats, and the threats they face.

__ Dedicate my science fair project to bats

__ Plant a native bat garden that will attract insects that bats like to eat

__ Pull for bats - remove non-native invasive plants

__ Turn off anything that uses electricity when it isn't needed, especially lights.

__ Plant a native tree to help provide places for bats to roost

__ Create a compost pile (this will create excellent habitat for insects, which can attract bats)

__ Take time to see live bats by visiting a public bat viewing site. You can find a list at batcon.org/AZA.

__ Volunteer! I can help protect bats on public lands by helping with bat counts, acoustic monitoring, and much more.

__ Post updates on my accomplishments to the "Project EduBat" Facebook page (https://www.facebook.com/ProjectEduBat) to share my efforts to make a difference.

Curriculum Connections

Project EduBat activities always list curriculum connections for Next Generation Science Standards and for Common Core State Standards. Hopefully you can see that this Bat Squad activity is very different because it asks students to do a multitude of Service Learning projects to protect bats. The curriculum connections will obviously include science. Projects are also very likely to have many cross-curriculum connections, including math, reading, writing, civics, technology, art, and music.

Language Arts Example

Several Bat Squad Service Learning projects have extensive research, reading, and writing requirements. These include: Bat Chat – Spread the Word about the Importance of Bats; Write a Letter to Your Local, State, and National Representatives; Fundraise for Bats; and Dedicate Your Science Fair Project to Bats. Examples of Literacy Standards that could be connected to these projects are included below.

Common Core State Standards:

Literacy: High School CCSS.ELA-LITERACY.W.9-10.2 Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. Research to Build and Present Knowledge.

CCSS.ELA-LITERACY.W.9-10.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

CCSS.ELA-LITERACY.W.9-10.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. Production and Distribution of Writing.

CCSS.ELA-LITERACY.W.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience (Grade-specific expectations for writing types are defined in standards 1-3 above).

CCSS.ELA-LITERACY.W.9-10.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience (Editing for conventions should demonstrate command of Language standards 1-3 up to and including grades 9-10 here).

CCSS.ELA-LITERACY.W.9-10.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

CCSS.ELA-LITERACY.RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-LS2-4)

CCSS.ELA-LITERACY.RI.8.8 Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. (MS-LS2-4)

CCSS.ELA-LITERACY.WHST.6-8.1 Write arguments to support claims with clear reasons and relevant evidence. (MS-LS2-4)

CCSS.ELA-LITERACY.WHST.6-8.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (MS-LS2-4)

Science Example

All Bat Squad Service Learning projects have connections to science standard requirements. If projects are related to white-nose syndrome and/or other threats to bat populations, the Next Generation Science Standards that could be connected to these projects are included below.

Next Generation Science Standards

Middle School Life Science
Students who demonstrate understanding can:

MS-LS2-4. Ecosystems: Interactions, Energy, and Dynamics: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

High School Life Science

Students who demonstrate understanding can:

HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

HS-LS2.C: Ecosystem Dynamics, Functioning, and Resilience: A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-2),(HS-LS2-6)

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. (HS-LS2-7)