

Bio/Diversity Project
Lesson Title: Introduction to Sonoran Desert Pollinators

Teacher: Karina Garcia, Eleanor McDonough, Haley Limes

Grade Level: 6-8th

Time: 50 minutes

<https://www.denix.osd.mil/nr/focus-areas/pollinators/guidance/pollinators-of-the-sonoran-desert-guide-2004-02-1703/>

https://www.esi.utexas.edu/files/107_Explore-Pollination.pdf

web.csulb.edu/~lhenriqu/2-4-Pollination.pdf

<p>AZ State Science Standard:</p>	<p style="text-align: center;">6.L2U1.14</p> <ul style="list-style-type: none"> ● <i>Construct a model that shows the cycling of matter and the flow of energy in ecosystems.</i> ● The flow of the way a source of energy, (pollen), is being moved throughout an ecosystem through animals such as pollinators, moving pollen throughout an ecosystem to a plant to help them reproduce.
<p>Content Objective: Math, Reading, Science, Writing, Other:</p>	<ul style="list-style-type: none"> ● Students will be able to identify different types of pollinators in the Sonoran Desert. ● Students will be able to explain the role of pollinators in the Sonoran Desert. ● Students will utilize teamwork and memory to complete activities given in class.
<p>Language Objective: (Optional)</p>	<p>“N/A”</p>

Scientist of the Week:	<ul style="list-style-type: none"> ● Eijiro Miyako ● Engineer and Scientist ● Japan ● He made robotic pollinators
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Vocabulary	Materials
Provide a bulleted, alphabetized list of words that students will hear, speak, write, and/or read about in the lesson. These words are integral to developing content understanding: <ul style="list-style-type: none"> ● Pollinators ● Species 	Provide a bulleted list of relevant materials for the lesson. <ul style="list-style-type: none"> ● Blank paper ● Colored chalk ● Cotton balls ● Q-tips

Seasonality: (If more specificity is required, please note date/time range under the season)

<i>Monsoons</i> July-Sept.	<i>Autumn</i> Oct.-Nov.	<i>Winter</i> Dec.- Feb.	<i>Spring</i> Mar.- Apr.	<i>Dry Summer</i> May-June
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Guiding Questions: <ul style="list-style-type: none"> ● Why are pollinators important? ● What do pollinators do? ● What are some examples of pollinators? ● How do pollinators spread pollen?
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Engagement/Introductory Activity:

- We will have the students talk to one another about what they believe a pollinator is, what are some pollinators in the Sonoran Desert, and why are they important? After asking the students what they believe to be examples, we will present a few Sonoran Desert pollinators.

Exploratory Activity:

- Students will draw a simple flower on their paper using the projected images as a guide for how they should look.
- Students will be given different colored chalk (green, blue, pink and yellow) and be asked to color the center of their flower.
- Students will be split into four groups based on the color of their chalk and receive a q-tip or cotton ball. They will rub both of these tools in their own chalk in order to rub onto another student's paper.
- Groups will then perform a relay, as one student goes to pollinate other flowers and the others wait. Students will be instructed to remember classroom etiquette during the activity. This will be timed for approximately 5 minutes.

Explain:

- Students will perform a think pair share of the following questions:
 - Why are pollinators important
 - What are some pollinators in the sonoran desert
 - Why is it important to have different pollinators

Extension Activity/Questions:

- Students will give a short (1 min) presentation in their assigned groups on an assigned pollinator using the information provided by the interns.

Evaluation Activity:

- Kahoot!!!

<https://create.kahoot.it/share/biodiversity-project-week-1/495adcf0-0bc1-4c62-b233-31ae219ec151>

Bio/Diversity Project

Basic Plant Morphology/Anatomy

Teacher: Karina Garcia, Hayley Limes, Eleanor McDonough

Grade Level: 6th/7th/8th

Time: 45 minutes

https://lpi.oregonstate.edu/sites/lpi.oregonstate.edu/files/pdf/hyp/lessons-manuals/K12/K5/grade_two_pollinator_adaptations.pdf

<https://www.towergarden.com/content/dam/towergarden/resources/lesson-plans/grades-5-and-up-plant-fertilization.pdf>

<https://betterlesson.com/lesson/633272/the-beauty-of-a-flower-structure-and-function>

AZ State Science Standard:	6.L2U1.13 <ul style="list-style-type: none">● <i>Develop and use models to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors.</i>
Content Objective: Math, Reading, Science, Writing, Other:	<ul style="list-style-type: none">● <i>Students will be able to recognize basic plant structures.</i>● <i>Students will be able to identify three different plant parts by the end of the class.</i>● <i>Students will be able to identify where pollinators receive pollen</i>
Language Objective: (Optional)	"N/A"

Scientist of the Week:	<ul style="list-style-type: none"> ● <i>Rachel Carson</i> ● <i>Marine Biologist</i> ● <i>Pennsylvania</i> ● <i>Author of the book Silent Spring and was against pesticide use</i>
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Vocabulary		Materials		
Provide a bulleted, alphabetized list of words that students will hear, speak, write, and/or read about in the lesson. These words are integral to developing content understanding: <ul style="list-style-type: none"> ● Pollen ● Anther ● Stigma ● Petals 		Provide a bulleted list of relevant materials for the lesson. <ul style="list-style-type: none"> ● Flowers for dissection (17 kids for Eleanor’s class, and 12 for Karina’s and Hayley’s class) ● Watercolor paper ● Glue sticks ● Multi-colored tissue paper ● Pens 		
Seasonality:				
<i>Monsoons</i> July-Sept.	<i>Autumn</i> Oct.-Nov.	<i>Winter</i> Dec.- Feb.	<i>Spring</i> Mar.- Apr.	<i>Dry</i> <i>Summer</i> May-June
Guiding Questions:				
<ul style="list-style-type: none"> ○ What jobs do the different parts of the flowers do? ○ Why do some flowers look similar? ○ Why are plant structured like this? 				

Engagement/Introductory Activity:

- We will show them the video of different flowers blooming and we will ask them to write similarities on paper provided.
 - https://youtu.be/xW_AsV7k42o
 - After Interns will call on students displaying good classroom behavior (ie: one who is sitting quietly in their seat and raising their hand) to share the similarities

they saw (similar structures) and why they think these flowers share these traits. -
The lesson reference is at the top of the page.

Exploratory Activity:

- Each student will then be given a flower and will perform a flower dissection.
 - Interns will define the plant parts and their functions at each step of the dissection. Students will be asked to place their plant parts in the matching boxes of the worksheets provided.
 - They will lightly pull off the petals from the flower to reveal the inner workings of the flower.
 - Students will then identify and remove the anthers from the flowers. They will be asked to observe the pollen on the anthers.
 - Students will then remove and identify the stigma.
 - **Pollen:** The reproductive material of the the plants (like seeds)
 - **Anther:** The part where pollen is produced.
 - **Pistil:** Female part of the flower that helps transfer pollen.
 - **Stigma:** The part of the pistil where pollen forms.
- At the end of the dissection the interns will collect the papers and plant parts to use in the extension activity.

Links to Worksheet:

https://askabiologist.asu.edu/sites/default/files/resources/coloring_pages/pdf/aab_flower_anatomy_activity.pdf

Explain:

- Students will work in groups of 3-4 to complete and label the flower diagrams provided by the interns. They will label the following terms.
 - Anther
 - Petal
 - Stigma
- Students will then help the interns to “pin the petal on the flower”
 - Interns will post a flower poster to the front of the class using the projector. They will ask the class where on the flower they should label the petals.
 - Interns will call on a student who is displaying good classroom behavior. The student will then tell the class the function of the flower part and where on the diagram it belongs.
 - The intern will then ask the rest of the class if they agree by giving a thumbs up of a thumbs down.
 - If the students agree the intern will label the flower accordingly
 - If the students disagree the intern will call on one student displaying good classroom behavior to explain why they think the other student might have been mistaken.
 - If the class agrees, then the flower will be relabeled.
 - Afterwards, the class will talk about the posterboard and see if it looks right. If some labels are misplaced, interns replace the labels and ask the students to think about why the misplaced labels were moved.

Link to worksheet (used for both student and projector):

file:///C:/Users/soont/OneDrive/Documents/BioDiversity/Worksheet%20Lesson%20Plan%20202.pdf

Extension Activity/Questions:

- Students will be asked to think about important parts of their home and family and compare these to the parts of a flower:
 - Ex: My mother is like the stem of the flower because XYZ
 - Ex: This food is the pollen on my flower because XYZ
 - A few students who are displaying good classroom behavior will be called on to give an example of their comparisons.
- Students will then make a collage of their home as a flower and label the different parts of their drawing.
 - Students will be passed back their flower parts from the dissection.
 - They will be given a white piece of watercolor paper, the parts of their flowers, colored pencils (reused from previous lesson), glue, multicolored tissue paper, and pens.
- Students will be asked to take this collage home to their family and use it to explain basic flower anatomy to their household.

Evaluation Activity:

- A Kahoot during the last five minutes of class
- <https://create.kahoot.it/share/biodiversity-project-week-2/0d5e7795-0546-485b-a392-5b686d9daeca>

Bio/Diversity Project
Lesson Title: Plant Adaptations and Pollinators

Teacher: Karina Garcia, Eleanor McDonough, Haley Limes

Grade Level: 6-8th

Time: 46 minutes

<https://www.calacademy.org/educators/lesson-plans/flowers-seeking-pollinators>

https://lpi.oregonstate.edu/sites/lpi.oregonstate.edu/files/pdf/hyp/lessons-manuals/K12/K5/grade_two_pollinator_adaptations.pdf

<https://www.pollinator.org/PDFs/Guides/AmericanSemiDesert.rx8.pdf>

<p>AZ State Science Standard:</p>	<p style="text-align: center;">6.L2U1.14</p> <ul style="list-style-type: none"> ● <i>Construct a model that shows the cycling of matter and the flow of energy in ecosystems.</i> ● The flow of the way a source of energy, (pollen), is being moved throughout an ecosystem through animals such as pollinators, moving pollen throughout an ecosystem to a plant to help them reproduce.
<p>Content Objective: Math, Reading, Science, Writing, Other:</p>	<ul style="list-style-type: none"> ● <i>Students will be able to give examples of plant adaptations.</i> ● <i>Students will be able to justify why plants adapt.</i>
<p>Language Objective: (Optional)</p>	<p>“N/A”</p>

Scientist of the Week:	<ul style="list-style-type: none"> ● Kathleen Walker ● Entomologist- A person who studies bugs ● California ● Trying to stop humans from getting sick from mosquitos
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Vocabulary	Materials
<p>Provide a bulleted, alphabetized list of words that students will hear, speak, write, and/or read about in the lesson. These words are integral to developing content understanding:</p> <ul style="list-style-type: none"> ● Pollinators ● Species ● Adaptations 	<p>Provide a bulleted list of relevant materials for the lesson.</p> <ul style="list-style-type: none"> ● 9 Pollinator and 9 Plant cards ● String ● Pollinator cards ● 1 hole punch ● Sticky notes ● Writing utensils ● Printed data Sheets

Seasonality: (If more specificity is required, please note date/time range under the season)

<i>Monsoons</i> July-Sept.	<i>Autumn</i> Oct.-Nov.	<i>Winter</i> Dec.- Feb.	<i>Spring</i> Mar.- Apr.	<i>Dry Summer</i> May-June
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<p>Guiding Questions:</p> <ul style="list-style-type: none"> ● How do plants attract pollinators? ● What traits about flowers you've seen stick out to you? ● Why do you think plants change?

Engagement/Introductory Activity:

- Students will be asked to imagine what their favorite flowers look like paying special attention to what we learned about our flowers in the previous lessons, as well as the colors and smells the flower might have.

- Students will be given a sticky note and asked to draw or write how their household responded to their take home project from the previous lesson on one side. On the other they should somehow indicate where their favorite flower comes from. Once they are done with this, they can walk up to the front of the classroom to trade their sticky note for the materials in the next step.
- Students will be given blank pieces of paper and colored pencils/pens in order to draw what they're favorite flower looks like. They should identify key characteristics such as;
 - Shape
 - Color
 - Size
- Once they have done this, the sticky notes will be passed out randomly, and students will be asked to find the owner of the sticky note they received and have that person explain their sticky note to them.

Exploratory Activity:

- Students will be given 10 seconds (with interns counting) to return to their seats.
- Interns will then pass out a data sheet with the Sonoran desert pollinators (different sheets will have different pollinators) and Sonoran desert flowers (see flowers seeking pollinators tables for inspiration)
 - This will be adapted to have minimal writing, mostly numbers, and pictures
 - [file:///C:/Users/soont/OneDrive/Documents/BioDiversity/Pollinator%20Data%20Sheet%20\(1\).pdf](file:///C:/Users/soont/OneDrive/Documents/BioDiversity/Pollinator%20Data%20Sheet%20(1).pdf)
- Interns will explain the activity as follows (either while placing flower sheets down or one will explain while the other sets up the flower stations): Students will then travel to sheets the interns have placed around the room. The sheets will show a picture of a Sonoran desert flower and several pollinators that have visited it (IE: 5 monarch butterfly pictures, 3 Carpenter Bee pictures, etc). They will record the number of times their pollinator visits each flower using their datasheet.
- Students will then be asked to repeat the goals and rules of the activity:
 - Interns should look for:
 - Making tally marks for how many pollinators are at a flower
 - Walking instead of running
 - Visiting all the flowers in the room
- Students will then be given 5-10 minutes to complete their data sheets
- Students will be asked to find others who had the same pollinator on their data sheet and to sit with them (groups of 3-5).
- Together, they will be asked:
 - to determine which flower their pollinator visited the most.
 - to compare and contrast their flower with the other flowers present
 - Two differences and two similarities
 - Students should be reminded to think about the same things they did at the beginning of class, like odor and color
 - During this time a flower facts sheet will be on the board, with pictures and important characteristics of each flower. Interns will walk around the room to help students read the board. It should be made clear before this

part of the activity begins that if students in the group cannot read the board or are stuck on words that they should raise their hands and the interns will be there to read the board aloud and explain.

- Students will then be asked why their pollinator might like about the flower (ex: if it's a bat it blooms at night, etc)
 - During this time a pollinator like sheet will be on the board, with clear pictures and preferences. Interns will walk around the room to help students read the board. It should be made clear before this part of the activity begins that if students in the group cannot read the board or are stuck on words that they should raise their hands and the interns will be there to read the board aloud and explain.

Explain:

- Students will perform a think pair share of the following questions:
 - Why do some flowers look different than others?
 - Why do you think your favorite flower looks like it does?

- Students will give a 1-minute presentation about which flower their pollinator went to the most and why they think their pollinator choose that flower.
 - Interns announce the part of the project and students will be given 30 seconds to talk to their group about the presentation
 - Students should be reminded to focus on what characteristics of the flowers attract the pollinators
 - Students will be asked to sit in a circle on the floor with their group mates next to them. Before presentations, interns will call on three people displaying good classroom behavior to remind the class of what they should be doing during presentations. (interns might pass out play dough/other so more fidget students can have something to occupy their hands?)
 - Interns will then either ask for volunteers or pick the groups who will present until all the groups have presented

Extension Activity/Questions:

- Students will receive a necklace card with either a Sonoran desert plant or a Sonoran desert pollinator (Cards will have info about both plants and animals)
- Students will then be given 5 minutes to read their cards with the help of interns and find their “match” aka a likely plant-pollinator combination.
 - Our other culturally relevant piece.

Evaluation Activity:

- Kahoot!!!

<https://create.kahoot.it/share/biodiversity-week-3/3061b0f6-7a13-4a74-a2fe-d832d8900848>



Anna's Humming Bird



Desert Milkweed



Ashy Limberbush



Photo by Dave Harvey

Night Blooming Cereus



Desert Rose



Lesser Long Nosed Bat



Desert Milkweed



Ashy Limberbush



Photo by Dave Harvey

Night Blooming Cereus



Desert Rose



Carpenter Bee



Desert Milkweed



Ashy Limberbush



Photo by Dave Harvey

Night Blooming Cereus



Desert Rose



Monarch Butterfly



Desert Milkweed



Ashy Limberbush



Photo by Dave Harvey

Night Blooming Cereus



Desert Rose

WHICH FLOWERS DO THE POLLINATORS PREFER?	Plant Trait	POLLINATOR						
		Bats	Bees	Birds	Butterflies	Flies	Moths	Wind
<p>NOT ALL POLLINATORS ARE found in each North American province, and some are more important in different parts of the United States. Use this page as a resource to understand the plants and pollinators where you live.</p> <p>Plants can be grouped together based on the similar characteristics of their flowers. These floral characteristics can be useful to predict the type of pollination method or animal that is most effective for that group of plants. This association between floral characteristics and pollination method is called a pollination syndrome.</p> <p>The interactions of animal pollinators and plants have influenced the evolution of both groups of organisms. A mutualistic relationship between the pollinator and the plant species helps the pollinator find necessary pollen and nectar sources and helps the plant reproduce by ensuring that pollen is carried from one flower to another.</p>	Color	Dull white, green or purple	Bright white, yellow, blue, or UV	Scarlet, orange, red or white	Bright, including red and purple	Pale and dull to dark brown or purple; flecked with translucent patches	Pale and dull red, purple, pink or white	Dull green, brown, or colorless; petals absent or reduced
	Nectar guides	Absent	Present	Absent	Present	Absent	Absent	Absent
	Odor	Strong musty; emitted at night	Fresh, mild, pleasant	None	Faint but fresh	Putrid	Strong sweet; emitted at night	None
	Nectar	Abundant; somewhat hidden	Usually present	Ample; deeply hidden	Ample; deeply hidden	Usually absent	Ample; deeply hidden	None
	Pollen	Ample	Limited; often sticky and scented	Modest	Limited	Modest in amount	Limited	Abundant; small, smooth, and not sticky
	Flower Shape	Regular; bowl shaped – closed during day	Shallow; have landing platform; tubular	Large funnel like; cups, strong perch support	Narrow tube with spur; wide landing pad	Shallow; funnel like or complex and trap-like	Regular; tubular without a lip	Regular; small and stigmas exerted
	This chart and more information on pollinator syndromes		http://www.fs.fed.us/wildflowers/pollinators/syndromes.shtml					

<https://www.pollinator.org/PDFs/Guides/AmericanSemiDesert.rx8.pdf>





Photo by Dave Harvey





Bio/Diversity Project

Bees As Pollinators in the Sonoran Desert

Teacher: Karina Garcia, Hayley Limes, Eleanor McDonough

Grade Level: 6th/7th/8th

Time: 45 minutes

<https://www.nps.gov/teachers/classrooms/upload/BeeWeek-MiddleSchool.pdf>

https://www.exploringnature.org/graphics/adaptation_jpgs/bumblebee_adaptations.pdf

AZ State Science Standard:	<p>6.L2U1.13</p> <ul style="list-style-type: none">● <i>Develop and use models to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors.</i>
Content Objective: Math, Reading, Science, Writing, Other:	<ul style="list-style-type: none">● <i>Students will be able to identify the difference between bees in the Sonoran Desert.</i>● <i>Students can recognize a native bee that's in the Sonoran Desert, the Sonoran Bumblebee and its behavior, and traits.</i>● <i>Students will be able to describe how bees pollinate plants and flowers.</i>
Language Objective: (Optional)	"N/A"

Scientist of the Week:	<ul style="list-style-type: none"> ● <i>Wangari Maathai - Activist</i> ● <i>Founder of the Green Belt Movement</i> ● <i>First African woman to win a Nobel prize</i> ● <i>From Kenya</i>
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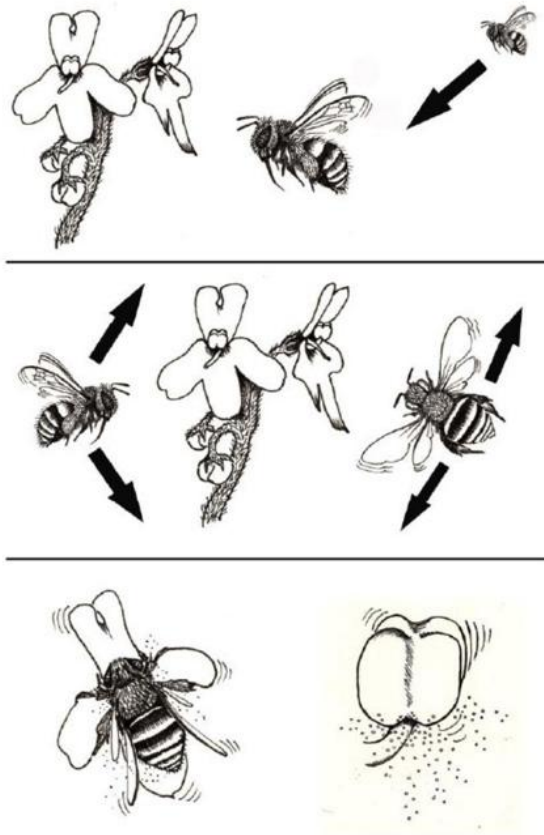
Vocabulary	Materials
<p>Provide a bulleted, alphabetized list of words that students will hear, speak, write, and/or read about in the lesson. These words are integral to developing content understanding:</p> <ul style="list-style-type: none"> ● Native ● Buzz Pollination 	<p>Provide a bulleted list of relevant materials for the lesson.</p> <ul style="list-style-type: none"> ● Pipe cleaners (multicolored) ● Paper ● Pencils ● Colored Pencils ● Markers ● Beads, multicolored ● 3x5 Index Cards

Seasonality:				
<i>Monsoons</i> July-Sept.	<i>Autumn</i> Oct.-Nov.	<i>Winter</i> Dec.- Feb.	<i>Spring</i> Mar. !	<i>Dry Summer</i> er May- June

<p>Guiding Questions:</p> <ul style="list-style-type: none"> ○ What is the difference between our Native bee in the Sonoran Desert and other bees that live in the United States? ○ How do Sonoran Bumblebees pollinate flowers? ○ Why do bees look different?
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Engagement/Introductory Activity:

- We will show a video of The Sonoran Bumblebee pollinating,
 - [https://youtu.be/ LuqUFfOfos](https://youtu.be/LuqUFfOfos)
 - “Bumblebees spin a silk cocoon inside their waxen brood cells. At first glance, bumblebee nests appear chaotic and unorganized. Instead of back-to-back neat hexagonal cells like those fashioned of wax by honey bees, bumblebees create lumpy cells for pollen and nectar storage and egg-shaped ones in which larvae develop.”
<https://www.fs.fed.us/wildflowers/pollinators/pollinator-of-the-month/SonoranBumblebee.shtml>
 - They use a method called; Buzz Pollination/Sonication; Buzz pollination or sonication is a technique used by some bees, such as solitary bees to release pollen which is more or less firmly held by the anthers.
 - We will then have the kids share one thing they noticed about the way the bees pollinated the flowers or if they notice anything that stood out to them the most, and then the interns will explain what they did in the video and show a step by step outline of what the bees did in a simple 3 steps so it is not confusing in any way for the kids.
 - Step 1: The bee comes toward the flower and hovers over it.
 - Step 2: The bee gets ready to clasp onto the flower anthers.
 - Step 3: The bee uses its wings to vibrate them to release pollen, much like a saltshaker.
- Students will then be asked what physical adaptations of bees allow for this method of pollination to be effective.
 - The term Physical Adaptation will be defined beforehand.
 - Answer: Bees are able to use this behavior as they have specialized hairs that pollen sticks to.



<https://gesneriads.info/articles/saintpaulia/saintpaulia/pollination/>

Exploratory Activity:

- Students will be asked to “engineer” a bee that would be well suited to where they call home and to help pollinate plants and compare this bee to the Sonoran honey bee.
 - Students will have an image projected while they are making their bees to reference. The image will include adaptations the honey bee has to collect pollen, such as how bees communicate and the physical structures they use to move pollen.
 - Interns will introduce the image and the adaptations, and asking for students to describe why bees might have these adaptations rather than others.
 - They will need to take into consideration the way bees pollinate flowers, where bees live, how bees reproduce, and what plants they would need to pollinate into their creation of both their new bee and apply their learning in the creation of their Sonoran honeybee.
 - Students will then be given access to pipe cleaners, beads, paper, and pencils. Interns will allow tables exhibiting good classroom behavior to walk up and select their materials

- Students will then craft both a Sonoran honeybee and their bee out of materials listed for approximately 5-10 minutes.
- After ten minutes are done or most students appear to be finished students will be put into groups of two and asked to explain how and why they designed their bees.

Explain:

- To introduce the students to bees, we will first ask them to look up the following questions on their tablets:
 - “What do bees make?”
 - “What Bees are Native to Arizona”
 - Interns will call on students displaying good classroom behavior and write their suggestions on the front board.
 - Interns will also walk through the classroom and interact with students during this activity to ensure the students are on task and can successfully read the search results.
- Next, we will show them pictures of different kinds of bees that reside in Arizona. Such as; Honeybees, Bumblebees, Carpenter bees, Cuckoo bees, and Mason bees. We will have a description of what each bee does specifically.
 - We will have them spot similarities and differences between the bees and then we will have them guess which one they think is Native to Arizona.
 - We will explain to the kids what the word Native means before asking them this question.
- Students will then be asked to think of the previous lesson and what they have just learned about native and not native organisms to infer whether native or non-native bees would be better at pollination in the sonoran desert and why.
 - The question will be broken into: Which bees would be better at pollinating here? Why? Why does adding new bees to an ecosystem not increase biodiversity?
 - Interns will make sure to contrast this example of how non-native species are bad for ecosystems with positive examples of how cultures mixing/immigration have been positive for their community.
 - Ex: You might have had chinese, or mexican, or russian food. We could have all these different types of food if people from those countries hadn’t come to the US.
- We will then show them which bee is Native to the Sonoran Desert, which is, *Bombus sonorus*, The Sonoran Bumblebee. We will repeat the description again of what The Sonoran Bumblebee does and have them repeat it back to us.



<https://www.fs.fed.us/wildflowers/pollinators/pollinator-of-the-month/SonoranBumblebee.shtml>

Extension Activity/Questions:

- Students will be asked to create a postcard.
 - Students will be given a 3x5 index card to create their postcard.
 - They will draw or write on one side of the postcard using the materials given to them.
 - The students will be provided with colored pencils and markers.
 - This postcard will highlight where the bee they created in their explore activity is from.
 - It will also highlight the special adaptations they created for their bee to spread and receive pollen.
 - They can draw a picture of where they want the bee to be from and features showing their bees adaptations to help pollinate plants. If they want to write down sentences they can with help from the interns if asked.
- The postcard along with the students' "engineered" bee will be taken home to the students' parents and the students will be asked to explain to their parents the adaptations they created for their bee.

Evaluation Activity:

Kahoot!

<https://create.kahoot.it/share/ac94d45f-66b0-4f2e-ad76-ecdb07cc07e9>

Bio/Diversity Project

Bats As Pollinators in the Sonoran Desert

Teacher: Karina Garcia, Hayley Limes, Eleanor McDonough

Grade Level: 6th/7th/8th

Time: 45 minutes

https://biodiversityproject.arizona.edu/sites/default/files/Eighth%20Grade_Sonoran%20Desert%20Butterflies%20and%20Bats%20Curriculum.pdf

<p>AZ State Science Standard:</p>	<p>Game of life-bats</p>
<p>Content Objective: Math, Reading, Science, Writing, Other:</p>	<ul style="list-style-type: none">• <i>Students will be able to recognize the life cycle of bats.</i>• <i>Students will be able to identify adaptations bats have to pollinate plants.</i>• <i>Students can learn about the bat boxes we will be doing and think about good bat boxes.</i>
<p>Language Objective: (Optional)</p>	<p>“N/A”</p>

Scientist of the Week:	<ul style="list-style-type: none"> ● <i>Valeria Madera-Garcia</i> ● <i>Puerto Rico</i> ● <i>Completed a project about nutrition and population density as determinants of mosquitoes larvae survival.</i> ● <i>She enjoys: CROSSFIT, sailing, traveling, reading, cooking, and playing video games</i>
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Vocabulary	Materials
<ul style="list-style-type: none"> ● Echolocation ● Migration 	<ul style="list-style-type: none"> ● Colored square paper (~30 - 50 sheets) ● Game of life board (large enough for students to play) ● Paper ● Colored pencils

Seasonality:

<i>Monsoons</i> July-Sept.	<i>Autumn</i> Oct.-Nov.	<i>Winter</i> Dec.- Feb.	<i>Spring</i> Mar.-Apr.	<i>Dry Summer</i> May-June
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Guiding Questions:

- What adaptations do you think that this bat has?
- What do you think it eats?
- How do you think they pollinate flowers?
- Has anyone in the class seen a bat box?
- Does anyone in the class know what bat boxes are?
- From our activity, what do you think bat boxes do and how do they help bats?

Engagement/Introductory Activity: (~ 10 mins)

- Have students guess how many bat species live in the Sonoran desert:
 - Answer: (on PowerPoint) nearly 1000
- Tell students that the bat we are focusing on today will be the Lesser Long-Nosed Bat
- Show the following video: <https://www.youtube.com/watch?v=aPNolsDEM5E>
- Ask the students the following questions:
 - What adaptations do you think that this bat has?
 - What do you think it eats?
 - How do you think they pollinate flowers? (In a previous slide of the presentation it would be helpful to include a bat with pollen on its face to give students a clue)
 - Call on students showing good classroom behavior and write answers on the board (if one student wants to write, call on them to do so)
- Go over some behavioral and physical adaptations of bats (including some that students noticed in the previous question), specifically defining echolocation and migration.
 - Once the definitions of echolocation and migration have been given, have the students repeat the word and definition back to the intern.
- Tell students what the Lesser Long-Nosed Bat eats and how it pollinates flowers. Use correct student examples if they are present.
- Students will make their own origami bat game pieces for the explore activity
 - Pass out square origami or other colored paper (should be multicolored so students can know which bat it theirs)
 - Draw student attention to slides and go through steps one by one (either using stills of interns doing the folds or video), stopping after each step to make sure all students are following
 - Interns will demonstrate with paper at the front of the class
 - When students finish, remind them to write their name/do something to their bat so they can recognize it
 - Instructions from this pattern/video:
<https://www.youtube.com/watch?v=48fDg2Kcw9A>

Exploratory Activity:(~ 15 mins)

- Students will participate in the “Game of Life: Bats”
- Break students up into pairs or groups of three depending on class size by counting off.
- Have all students sit in a circle on the floor with their group mates. Have each group place one bat on to the starting box
- Each group will roll a die and the group with the highest roll will move forward the same number of spaces as their roll number (if a tie all students move). If a student lands on a numbered space, the interns will read the directions associated with space aloud.
- Play the game all the spaces have been hit, twenty minutes have elapsed, or until all groups have won.
- See the attached materials for both

- file:///C:/Users/soont/OneDrive/Documents/BioDiversity/Game%20Of%20Life%20Bats%20Lesson%20Plan%205.pdf

Explain: (~ 5 mins)

- Students will create the life cycle of a Lesser Long-Nosed bat using the information provided in the previous activity
- Show scrambled cards with life cycle events from the board game (ex: be born, migrate, learn to fly, etc) on the board to students, as well as a life cycle drawing (done by interns) with spaces for each event
- Call on students who are displaying good classroom behavior to explain where and why they think a specific event should go into a specific slot
- Ask the class to give a thumbs up if they think that this is correct, and a thumbs down if they think it is incorrect.
- If there are thumbs down, call on a student to explain why they think the other might be incorrect.
- Ask the class to give a thumbs up or down if they agree. If most students agree, change the board
- At the end of the activity, show the correct life cycle diagram. If there are any differences, call on students to guess why that might be. Explain the correct reasoning and have the class repeat the explanation back.

Extension Activity/Questions: (~ 10 mins)

- Introduce the idea of Bat boxes by asking:
 - Has anyone in the class seen a bat box?
 - Does anyone in the class know what bat boxes are?
 - From our activity, what do you think bat boxes do and how do they help bats?
- Call on students who show good classroom learning behavior
- Explain how Sonoran Desert Bats (especially the lesser long nose) can't use traditional bat boxes
- Pass out blank white paper to students and ask them to make and label their own design for a bat box that will meet the needs of a Lesser Long-Nosed Bat
 - Ask Students to include materials they would use, where they would put the box, what they would put on the inside of the box, and what they would put on the outside
 - Give students a seven-minute time limit (only as a maximum, if all students are done before this move onto the next activity)
- Collect finished papers, once all students are done or the seven-minute time limit has been reached.
- Introduce the action projects (aka bat boxes). Explain that interns will use these designs as inspiration and ask students to continue thinking about ideas to make good bat boxes.

Evaluation Activity:(~ 5 mins)

Kahoot!

<https://create.kahoot.it/share/3a35dd9d-972b-423c-a485-0d81f3e68fa1>

Bio/Diversity Project
Lesson Title: BioBlitz

Teacher: Karina Garcia, Hayley Limes, Eleanor McDonough

Grade Level: 6-8

Adapted from: <https://www.nationalgeographic.org/activity/neighborhood-bioblitz/>

Common Core Standard:	<ul style="list-style-type: none"> ● 6.L2U1.13 <ul style="list-style-type: none"> ○ Develop and use models to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors.
Content Objective: Math, Reading, Science, Writing, Other:	<ul style="list-style-type: none"> ● <i>Students will conduct a species inventory in their schoolyard</i> ● <i>Students will describe the biodiversity in the area in which they survey</i> ● <i>Students will map the distribution of organisms</i> ● <i>Students will publish their findings</i>
Language Objective: (Optional)	“N/A”

Vocabulary	Materials
<p>Provide a bulleted, alphabetized list of words that students will hear, speak, write, and/or read about in the lesson. These words are integral to developing content understanding:</p> <ul style="list-style-type: none"> · Abiotic · BioBlitz · Biodiversity 	<p>Provide a bulleted list of relevant materials for the lesson.</p> <ul style="list-style-type: none"> · Butcher Paper · Clipboards · Digital camera / smartphone · Maps of BioBlitz Area · Hand lens · Hula hoop · Markers · Notebooks · Pencils · Pens · Rope (6-8’) · Scissors · Species Identification Cards · Video: Wild Chronicles: Santa Monica BioBlitz · Internet Access

Seasonality:				
<i>Monsoons</i> July-Sept.	<i>Autumn</i> Oct.-Nov.	<i>Winter</i> Dec.- Feb.	<i>Spring</i> Mar.-Apr.	<i>Dry Summer</i> May-June
Guiding Questions:				
<ul style="list-style-type: none"> ● <i>Why would taking an inventory of all of the species in a natural area be useful?</i> ● <i>In what areas do you expect to find a variety of species?</i> ● <i>What human areas might affect the biodiversity you will inventory as part of the BioBlitz</i> 				

Before the Event:

There are multiple steps that need to be done before you share your lesson with your students in order for you to have a successful BioBlitz!

- Recruit expert volunteers
 - Reach out to a variety of possible experts, such as field scientists, college students, extension agents, master naturalist, and other enthusiast with expertise in natural history.
- Determine your map site
 - Use online and paper maps to plan where the experts and their participants will observe flora and fauna. If possible, obtain or reproduce maps so that students and other participants will also have them during the event.
- Track down equipment and set a site for “basecamp”
 - The [handout, BioBlitz: Suggested Equipment List](#), can guide you in obtaining the equipment your expert volunteers and participants will use to aid in observing species.
 - *Younger student groups may not require additional equipment if they are not using electronics to collect and report their data
 - Plan for a centralized location where groups can meet to test out technology and other equipment.
 - § Live specimens can be displayed for a short period of time before returning to their habitat. Only expert volunteers should handle live specimens.
 - § A basecamp can be an exciting, dynamic environment where expert volunteers, interns, and students can all come together before and after surveying the field.
- Develop strong relationships with your expert volunteers
 - Send volunteers information ahead of time so they can prepare themselves to work with students and engage all participants in having a meaningful, inspirational learning experience.
 - Send the handout, Bio blitzing for [Volunteer Experts: Tips for Engaging School Groups](#), to them in advance.
 - Provide an opportunity to visit the BioBlitz site and discuss needs and opportunities as part of a planning meeting.
 - Plan how your experts will be recognized as group leaders.
 - § For example, you can provide t-shirts, hats, or a simple name tag.

Engagement/Introductory Activity:

- Instruct students to do a “virtual-video-BioBlitz” as they watch a clip from the [Golden Gate bioblitz](#).
- Explain that a BioBlitz is an event where teams of citizen scientists help to identify as many species as possible in a natural area.
- When students watch the video, they will look for different species.
- Instruct students to raise, and then immediately lower, their hands or call out every time they see a different species of mammal, insect, fish, or bird in the video; and for more advanced students, include plants.
- Talk about what they saw in the video (about ten different animals, if you include humans, and more than ten plants).
 - Ask: *Why would taking an inventory of all of the species in a natural area be useful?*
 - Explain that scientists and others who are responsible for protecting natural environments need to understand the biodiversity there.
 - Ask: *How could taking an inventory of all of the species in a natural area be challenging?*
- Together with students, discuss areas nearby where they might look for biodiversity in their local environment.
 - Ask: *Where have you seen a variety of flowering plants? What conditions do flowering plants need to survive? What other species do flowering plants rely on?*
 - Tell students that they will be looking for pollinators within their BioBlitz field site and they will be using flowering plants as an indicator for where to look for these pollinators.
- If **time permits** have small groups of students use the [MapMaker Interactive](#) to find and create a map of the selected area where the class will conduct the BioBlitz.
 - Have students label the map with the help of the interns/teachers.
 - Ask: *What physical features can you identify? In what areas do you expect to find a variety of species? What human areas might affect the biodiversity you will inventory as part of the BioBlitz?*
 - Print a map of the school yard before class and hand each small group a physical map that they can mark with markers. Students should answer all the questions listed above.

Exploratory Activity:

- Discuss with students how they can work efficiently with the time they’ll have to conduct their BioBlitz.
- Put students in groups of two or three.
- Mark maps with where students will likely be.
- Have each student bring a notebook and pencil.
- Give each group a length of rope or hula hoop to mark their study area. Also, give each group a hand lens, a clipboard with copies of the [Species Identification Cards](#) worksheet and, if possible, a camera.
- Explain that they will have time first for silent observation and then for team observation, during which they can communicate with one another.
- Give students the following guidance:
 - For about five minutes, have students sit silently and observe their surroundings.
 - In their notebook, ask students to draw or describe in word any living things they see, hear or smell.
 - If they notice any animals, have them record notes on their data sheets or take a photograph if possible.

- After the silent observation, instruct students to choose an area to study and place their hula hoop or rope around it to mark it.
 - § You will need to decide how much the students can move rocks or soil to look for species
 - § A good general rule is that if they lift up a rock, they need to replace it where it was found.
- Ask students to avoid taking species from the study site, and to be sure to leave the site as they found it.
- Teach students to “Leave No Trace” when they explore or experience a natural environment. One of the seven LNT principles states “Leave rocks, plants, and other natural objects as you find them.”
- Have students make sure they leave no trace of their BioBlitz by returning all objects to their original place.
- Instruct students to as they conduct the BioBlitz, mark their finding on a map of the study area and also put as much information as possible about species found on the Species Identification Cards worksheet.
- Students will use smartphones/cameras/(tablets if they are allowed to bring them outside) and WIFI upload their photos onto a share google doc.

Explain:

- When students are finished with the inventory, move back into the classroom space.
- Open the shared google doc on the overhead projector to display the species found. Students can also view their own group’s photos on their individual tablets.
- Discuss biodiversity within and among the area’s students inventoried, with volunteer or intern per 1-2 groups. Ask:
 - How many pollinators were found?
 - What flowering plants were found and where?
 - What did the areas where the most pollinators were found look like?
 - What pollinators were found near flowering plants?
 - Have students consult expert resources, such as National Park volunteers, to identify organisms observed in the schoolyard BioBlitz and add more information to their species identification cards—creating an inventory representing the diversity of the area studied.
- Discuss any challenges encountered, such as sampling very small organisms or flying or crawling organisms, or physical factors such as rain and wind—and discuss possible effects on data.

Extension Activity/Questions:

- Have students use large butcher paper and markers to create a map showing the distribution of various pollinators and flowering plants within the study area.
- Have them cut out and attach the species identification cards to the map to visually display the concept of biodiversity for other students. Ask:
 - What abiotic factors may have had an effect on species found?
 - How could the way your group collected data have affected the species you found?
 - What would you do differently if you were to conduct another BioBlitz?
 - § Students may determine that doing the inventory in the early morning, or during a warmer season, might bring different results.

Evaluation Activity:

- [Kahoot!](#)

Additional Links/ Resources:

Field Guides:

[Common Plants of Saguaro National Park](#)

[Arthropods of the Sonoran Desert](#)

[Common Backyard Insects of Tucson](#)

[Pollinators of the Sonoran Desert](#)

[Invasive Species in the Sonoran Desert Region](#)

[Invasive Plants of the Sonoran Desert](#)

Lesson Plan Materials:

[Designing a BioBlitz Learning Experience](#)

Plant and Invertebrate Investigation Stations

[Species Identification](#)

[Plot Study Observations](#)

[Neighborhood BioBlitz](#)

[BioBlitz: Suggested Equipment List](#)

Volunteer Experts: Tips for Engaging School Groups

Bio/Diversity Project
Birds as Pollinators in the Sonoran Desert

Teacher: Karina Garcia, Hayley Limes, Eleanor McDonough

Grade Level: 6th/7th/8th

Time: 45 minutes

<https://www.washcoll.edu/live/files/4254-adaptation-artistry>

AZ State Science Standard:	<p>6.L2UI.13</p> <ul style="list-style-type: none">● <i>Develop and use models to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors.</i>
Content Objective: Math, Reading, Science, Writing, Other:	<ul style="list-style-type: none">● <i>Students will be able to identify at least one kind of Sonoran Desert bird.</i>● <i>Students will be able to explain how flowers and bird beaks have adapted together.</i>● <i>Students will use teamwork and problem solving to complete activities.</i>
Language Objective: (Optional)	N/A

Scientist of the Week:	<ul style="list-style-type: none"> ● <i>Barbara Blanchard DeWolfe, USA</i> <hr style="border: 0.5px solid black; margin: 5px 0;"/> <ul style="list-style-type: none"> ● <i>lifelong work on white-crowned sparrows</i> ● <i>studied living populations of Californian and Alaskan sparrows and documented key differences in their breeding behavior, gonads, and song structure.</i>
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Vocabulary		Materials		
<ul style="list-style-type: none"> ● Species diversity ● Migration ● Interdependence ● Biomimicry 	<ul style="list-style-type: none"> ● Chopsticks ● Straws ● Spoons ● Tape ● Marbles ● Seeds ● Beans ● Sand ● Paper cups ● Pink/Blue/Green/Orange sticky notes 			
Seasonality: (If more specificity is required, please note date/time range under the season)				
<i>Monsoons</i> July-Sept.	<i>Autumn</i> Oct.-Nov.	<i>Winter</i> Dec.- Feb.		<i>Spring</i> Mar.- Apr.
				<i>Dry Summer</i> May-June

Guiding Questions:

- How does the pollination method of the hummingbird compare to the pollination method of the bees?
- What are the advantages of bird advancements?

Engagement/Introductory Activity:

- Show the scientist of the week and have students repeat her accomplishments:
 - Barbara Blanchard De Wolfe, she studied breeding behavior in sparrows.
- Ask students if they can name any birds in the Sonoran Desert.
- Show the following video at 2x speed:
<https://www.youtube.com/watch?v=eYm1Z83BOSQ>
- Ask students if they have ever seen or heard any of the birds shown in the video.
 - By doing this, we will have the students conduct in a game of eye spy on a worksheet, using Sonoran Desert birds and some birds that are native to where our students are from.

I SPY WITH MY LITTLE EYE...



I SPY WITH MY LITTLE EYE CHECKLIST!



WHITE-WINGED DOVE



ANNA'S HUMMINGBIRD



GREEN JAY



HORNBILL



COMMON RAVEN



GAMBEL'S QUAIL



GILA WOODPECKER



Exploratory Activity:

- Give directions for a pollen relay.
 - Students will count off to be sorted into groups
 - Students will create a “beak” out of material provided, such as chopsticks, spoons, straws, tape, etc. Encourage students to be creative when making their beaks, and show instructor examples. Interns can help if needed.
 - Meanwhile, interns will place “flowers” around the classroom (ie: marbles, seeds, beans, sand in small paper cups) and each team will be given an empty cup.

- Teams of 3 or 4 will then line up, and one member will use their beak to visit 1 flower and attempt to bring back as much of it's "pollen" as possible.
- Rules (shown onboard):
 - You must only visit the first cup you come to
 - Walk and treat others with respect - it's not a race!
 - Once you have returned to your team you can't go again
 - Once each team member has gone your team is done and should sit down on the ground
 - The team with the most "pollen" in their cup wins
- Have students take 2 minutes to talk to each other about why they were or were not successful. During this time, interns should visit each team and ask to hear what they have to say.

Explain:

- Show pictures of different bird beaks (IE: Hornbill (native to Africa), Green Jay (native to Mexico), white wing dove, Anna's hummingbird) and ask:
 - What do you notice about the beak of this bird?
 - How is it similar/different?
 - What kind of food do you think it eats?
- Students will answer these questions using different colored sticky notes. They will then be asked to find others with the same color sticky note as for them and discuss their thoughts.

Extension Activity/Questions:

- Direct students to return to their seats and show them a picture of a white-winged dove, and ask "Have you seen this bird before?" and several Sonoran Desert native plants such as yucca, agave, barrel and saguaro cacti, desert willow
- Ask students to match the dove to the plant they think it would pollinate/eat
 - "White-winged doves eat seeds from desert willow trees, ocotillo, agave, as well as fruit from saguaro, organ-pipe and other cacti. They also sip nectar from saguaro cactus fruit." - Arizona Sonora Desert Museum
- Show slide describing how the dove pollinates it's plants and what food it eats
 - Video: <https://www.youtube.com/watch?v=ikxHjfgjpo>

Evaluation Activity:

- Students will participate in a kahoot activity: <https://create.kahoot.it/share/947adf31-1c7b-4f47-8214-a281d47b9ead>

Bio/Diversity Project

Action Project Week 1: Bat Boxes

Teacher: Karina Garcia, Hayley Limes, Eleanor McDonough

Grade Level: 6th, 7th, 8th

Time: 45 minutes

<https://www.nwf.org/Garden-For-Wildlife/Cover/Build-a-Bat-House.aspx>

AZ State Science Standard:	<p>6.L2U1.13</p> <ul style="list-style-type: none">● <i>Develop and use models to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors.</i>
Content Objective: Math, Reading, Science, Writing, Other:	<ul style="list-style-type: none">● <i>Students will be able to identify key aspects of why the Lesser long Nosed bat is losing habitat in the Sonoran Desert .</i>● <i>Students will be able to explain how making bat boxes will be beneficial to the Sonoran Desert Ecosystem</i>● <i>Students will be able to explain the materials used for the boxes and why they are best suited for this environment.</i>● <i>Students will use teamwork and problem solving to complete activities.</i>
Language Objective: (Optional)	"N/A"

Scientist of the Week:	<ul style="list-style-type: none"> ● <i>Karen Krebbs - Studies bats and mammals</i> ● <i>Arizona-Sonoran Desert Museum calls her a “Bat Scientist” even though she also studies birds and other mammals as well</i> ● <i>Works for the Arizona-Sonoran Desert Museum doing research on birds and mammals</i> ● <i>Wrote two books on the care of hummingbirds. Is currently running two research projects about bats while training national park service employees on how to capture and handle bats.</i>
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Vocabulary		Materials		
<ul style="list-style-type: none"> ● Bat house ● Biologist ● 	<ul style="list-style-type: none"> ● Printer Paper ● Black construction paper ● Markers ● Flashlights ● 4 wooden spoons made out of different wood ● Butter ● Thermostat with hot water ● Beads ● 5 small bowls 			
<p>Seasonality: (If more specificity is required, please note date/time range under the season)</p> <p>Students will have to create designs that are suitable at all times of the year.</p>				
<i>Monsoons</i> July-Sept.	<i>Autumn</i> Oct.-Nov.	<i>Winter</i> Dec.- Feb.		<i>Spring</i> Mar.- Apr.
				<i>Dry Summer</i> May-June

Guiding Questions:

- Why are some materials better to build bat boxes in this environment than others?
- Why is it important to protect bat habitats in the Sonoran Desert?
- How does the lesser Long nosed bat affect us?

Engagement/Introductory Activity:

- Interns will show the scientist of the week: *Karen Krebs*
 - Have students repeat her accomplishments back: works studying mammals and birds and training people how to handle bats at the Arizona-Sonora Desert Museum
- Show the following video to the 2:14 time mark <https://www.youtube.com/watch?v=L8CkElz6rdc>,
 - Small introduction on what bats do for the Sonoran Desert.
- Students will then write or draw on a sticky note one thing that the lesser long-nosed bat does for them or the Sonoran desert.
- Students will then crumple the paper up into a “snowball” and we will have the students get up from their seats and form a circle and throw their “snowball” into the middle.
 - Interns will remind students about classroom rules: underhand tosses only and not aimed at another person.
- Students will pick up a ball they didn’t make and find the owner, we will remind the students not to run or push.
- Students will then have the owner explain what their sticky note meant.
- Once students have returned the “snowball” they picked up, listened to their fellow scholar’s explanation, and explained their own “snowball”, students will throw their ball in the trash and return to their seats.

Exploratory Activity:

- Once most students are done show the following video: https://www.youtube.com/watch?v=iS8Ycz2Cy_w
- Call on students to share features they notice and write these on the board
 - Have individual students come up and write one at a time. Interns will help with spelling and/or anything else the student may need help with.
- Show a slide featuring the most important aspects of the box:
 - Places for the bat to grip
 - It is dry inside
 - Dark during the daytime
 - Interns will answer any questions the students have.
- Then we will have the students draw on a piece of paper provided by the interns, to draw what they believe a bat box would look like with those three important aspects, but can add their own design to it and color it.
 - This will help the students to be creative while also keeping in mind the main aspects of a bat box.
 - They can add designs of their own to make the box unique and creative.

Explain:

- Explain to students why building a bat box out of wood isn’t a good idea for the lesser long-nosed bat:
 - Ask students if anyone knows how hot it gets in the Sonoran Desert over the summer. (117 degrees)
 - Explain that wood will become really hot over the summer, so bats won’t want to live in that wood bat box.
 - Bats stay cold by living underground or under bridges where it’s cooler.

- Point out that bridges are usually made of concrete
 - Bats also like caves, which are made of rock similar to concrete
- Ask students consider why some bat boxes are painted different colors:
 - Students will form groups of three or four.
 - Each group will be given a flashlight and asked to shine it on a piece of white printer paper and black construction paper for 30 seconds from about an inch away.
 - Afterwards students will feel the paper to determine which feels warmer.

Bat House Color		
Recommendations Based on Average Daily High Temperatures in July		
Less than 85° F	=	black
85° to 95° F	=	dark brown or other dark shade
95° to 100° F	=	medium brown or other medium shade
100° F or greater	=	light tan or other light shade

Extension Activity/Questions:

- Now, even though wood isn't best, most people use wood to make bat boxes, so let's see which wood becomes hot slower.
- Next the students will perform an activity, we will be performing an experiment with wooden spoons made out of different types of wood. (While this is happening, interns will have pictures and instructions on the smartboard for help.)
 - First we will have 4-5 different kinds of spoons made out of different wood. We will have enough spoons for each student and for the interns to show.
 - Each student will be given a spoon at random and interns will tell them which kind of wooden spoon they have and to write it down on a sticky note.
 - We will split the students into groups of 3 or 4.
 - We will have a small bowl that will fit all 3-4 wooden spoons, depending on the number of students in the group.
 - We will have each student put their spoon in the bowl evenly, like so:



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- Then we will have one student in each group put a small amount of butter on the tip of the spoon with the help of the interns to make sure they don't put too much or too little. (And so they don't make a mess).



- Next we will have each student given a bead and put it right on top of the butter.



- We will have the students have a timer ready for their spoon using their iPads.
 - Next we will put the hot water from the thermostat into each bowl at the same time with the help of the interns/Erin, have students start their timer.
 - Each student will watch their spoon to see how quickly the butter slides off their spoon.
 - Have each student record their times on their sticky note.
 - Once everyone is finished have everyone put their sticky notes up on the wall in the front of the room and help clean up their area.
- When everyone is done we will see how fast each type of wooden spoon got hotter faster and which one took the amount of time.

Evaluation Activity:

- Show previously picked spots on the PowerPoint of their school, and around their school, where they could put the bat box.
 - Ask students to raise their hand for each location presented to describe a benefit or a disadvantage of the location.
 - If no students are answering, point out things like the height of the box, whether or not it is in the shade, or if it is in a high traffic area and ask the class if these things are a benefit or a disadvantage.
- If the school does not permit us to put a bat box on the premises we can ask the students where they believe we should put the bat box, somewhere safe and possibly somewhere that stays a little cooler than most places in Tucson.
 - Under a tunnel, bridge, or near a building that doesn't get too busy.

Bio/Diversity Project

Action Project Week 2: Bat Boxes

Teacher: Karina Garcia, Hayley Limes, Eleanor McDonough

Grade Level: 6th, 7th, 8th

Time: 45 minutes

AZ State Science Standard:	<p>6.L2U1.13</p> <ul style="list-style-type: none">● <i>Develop and use models to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors.</i>
Content Objective: Math, Reading, Science, Writing, Other:	<ul style="list-style-type: none">● <i>Students will be able to give examples of how protecting bats will be beneficial to them.</i>● <i>Students will be able to defend the key design aspects for their bat boxes.</i>● <i>Students will be able to describe why conservation is important</i>
Language Objective: (Optional)	"N/A"

Scientist of the Week:	<ul style="list-style-type: none"> ● <i>Merlin Tuttle</i> ● <i>From Hawaii</i> ● <i>Specialized in bat ecology, behavior, and conservation.</i> ● <i>currently active as founder and executive director of Merlin Tuttle's Bat Conservation</i>
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Vocabulary		Materials			
<ul style="list-style-type: none"> ● Conservation ● Endangered species ● Keystone species 		<ul style="list-style-type: none"> ● Printer Paper ● Repurposed cardboard ● Painters tape ● Markers ● Scissors 			
Seasonality: (If more specificity is required, please note date/time range under the season)					
<i>Monsoons</i> July-Sept.	<i>Autumn</i> Oct.-Nov.	<i>Winter</i> Dec.- Feb.		<i>Spring</i>	<i>Dry Summer</i>

			Mar .- Apr.	May- June
Guiding Questions: <ul style="list-style-type: none"> ● Why are making bat boxes important? ● What do you think would happen if bats were no longer here? ● What are the key aspects of bat boxes that keep them protected? ● Why is it important for humans to learn about conservation 				

Engagement/Introductory Activity:

- Ask students to write down anything they remember from the previous week about what bats do for us on a piece of paper.
 - Ask for volunteers to share their answers.
 - Interns will go over key aspects of bat boxes again.
 - Interns will also go over which wood was best at becoming hot slower in the most amount of time.
- Show the following video: <https://www.youtube.com/watch?v=UNkXe8jpoUg>
- Present the scientist of the week, Merlin Tuttle

Exploratory Activity:

- Explain modeling bat box prototype activity to students:
 - Today we're gonna make a model bat box out of cardboard. You can use whatever materials we give you to make your design. Try to think back to the video and what we have learned about bats to make sure it's something a bat would like to live in.
- Pass out markers, a cardboard box, scissors and tape to students. Make sure each student has their own pair of scissors.
- Allow students 20-25 minutes to complete this activity (timing using classroom clock) or until most students seem to be finished. During this time interns will walk around the classroom helping students and encouraging them to work together to come up with ideas.
 - Once the timer is up, remind the students it's okay if you didn't finish and we can finish it later if we have time at the end of class.
 - Be sure to remind students to keep a growth mindset. The more flaws you have the more you have to improve on and the more creative your end result can be!

Explain:

- Divide students into table groups
- Have students elaborate about each of the benefits their boxes have
- Have the students choose 2 benefits of each box
- Remind the students on the designs/ "blueprints" they made last week.
- Ask the students to present as a group all the benefits they found in their boxes by standing and speaking in front of the class.
- Interns will explain the benefits their boxes have.
 - Interns will show pictures of bat boxes with bats inside them on the PowerPoint.

Extension Activity/Questions:

- Students will play a Kahoot version of a guessing game.
 - Students will be split into teams of 3 or 4.
 - Students will be given a set period of time, (5mins).
 - Students will be given a set of questions from the interns that relate to bats and the bat boxes.
 - Students will use one iPad and put their team name.
 - “Which wood worked best in the wood activity we did last week?”
 - (This answer depends on when we would have done activity)
 - “Do bats need their boxes hot or cold?”
 - Cold!
 - “What color should we paint our bat box?”
 - Light tan!
 - “Which bat is native to our desert?”
 - Lesser Long-Nosed Bat!

Evaluation Activity:

- Students will do a BAT (be able to) exit slip
 - Students will be given an exit slip and asked to write one thing they learned that they think they should be able to teach to a friend, family, or another person they meet
 - Students will write or draw this fact on a piece of bat-shaped paper (cut out by interns ahead of time)

Bio/Diversity Project
Action Project week 3: Bat Boxes/Protecting pollinators

Teacher: Karina Garcia, Hayley Limes, Eleanor McDonough

Grade Level: 6th, 7th, 8th

Time: 45 minutes

https://northhempsteadny.gov/filestorage/16255/18642/Protecting_Pollinators_Classroom_Activity.pdf

AZ State Science Standard:	6.L2U1.13 <ul style="list-style-type: none">● <i>Develop and use models to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors.</i>
Content Objective: Math, Reading, Science, Writing, Other:	<ul style="list-style-type: none">● <i>Students will be able to explain how pollinators help our ecosystem.</i>● <i>Students can explain how bat boxes will protect lesser-long nosed bats in the Sonoran Desert.</i>● <i>Students recognize what native plants attract pollinators and why they are crucial to our environment.</i>● <i>Students will learn ways they can protect pollinators.</i>
Language Objective: (Optional)	"N/A"

Scientist of the Week:

- Gillian Bowser
- <https://source.colostate.edu/research-scientist-gillian-bowser-lauded-commitment-diversity-science/>
- Research scientist at Colorado state university
- She is focused on teaching students about the environment and ecology as well as creating citizen science projects
- Some of these projects include creating apps such as the Pollinator Hotshots to have citizens track pollinator decline.

Vocabulary		Materials		
<ul style="list-style-type: none">● Endangered species● Protecting Pollinators● Native● Biodiversity		<ul style="list-style-type: none">● Printer Paper● Repurposed cardboard● Painters tape● Markers● Scissors		
Seasonality:				
Monsoons July-Sept.	Autumn Oct.-Nov.	Winter Dec.- Feb.	Spring Mar.-Apr.	Dry Summer May-June
Guiding Questions:				
<ul style="list-style-type: none">● What are some ways pollinators help the environment?● Why are bats so important to the environment?● Why are native crucial to our environment and to pollinators?				

Engagement/Introductory Activity:

- Students will finish anything that needs to be finished with their prototype bat boxes.
 - Interns will pass out materials.
 - Interns will ask the students to come up and get their bat boxes two at a time with no running.
- Students will take about 5-7 minutes to finish any necessary touch-ups/finishes.
- Remind students why making bat boxes with certain materials is beneficial and will protect the bats.
- The beginning of this lesson will start out with the interns and students working together to create a concept map of why they think pollinators are important.
 - What do pollinators do for us?
 - They are responsible for helping a wide variety of different plants reproduce
 - This gives us food, flowers, clothing, and tons of other things
 - While different pollinators are in charge of pollinating different plants, losing even one pollinator means losing a ton of biodiversity, both in plants, the animals that eat them, and the products that humans can make
 - Students can shout answers to the interns or take volunteers.
- Show the following video: <https://www.youtube.com/watch?v=oUq6qRZfJw>
 - Interns will narrate over this video.
- Next, we will go over our scientist of the week;
 - Gillian Bowser - creates citizen science projects and researches biodiversity as well as pollinator decline

Exploratory Activity:

- Split students into four groups
- Give each student a three foot long piece of twine with a paperclip tied to the end and either a specific pollinator the students learned about this semester or an organism/human product that relies on that pollinator (Attached via tape & sticky note).
 - Some examples: Bats, Bees, Birds, Wildflowers, honey, sugaros, etc
- Give students five minutes to connect their strings to the other students they are connected to.
 - Students will connect their strings by looping the paper clips around other strings.
 - Students will be allowed to use their technology to look up pollinator relationships if needed.
 - Ex: Bats are connected to organ pipe cactus, Bees are connected to honey, Butterflies are connected to wildflowers and milkweed, sugaros are connected to saguaro fruit
- Once students are connected Interns will call on three pairs of students to explain how and why they are connected
- Interns will then call out events that could happen to threaten pollinators (Ex, habitat destruction of bats reduces their numbers, non-native bees out competing native bees would cause less efficient transport of pollen). They would then have that pollinator and every other student that isn't also connected to another pollinator.
- Interns will continue until the web has been fully deconstructed.

Explain:

- The interns will show the students on the board the many ways we can protect pollinators through pictures and having the interns talk about each picture and how it protects the pollinator. Examples:
 - Planting native plants
 - Making a bat box
 - Put out bird feeders
 - Don't use harsh chemicals outside
 - Make a yard sign for your front yard

- Spread awareness by telling your friends and family about how important they are
- Ask and remind the students why making bat boxes for the bats is so important.
- Show this video to the students on why bats are great for the environment.
 - <https://www.youtube.com/watch?v=45ifEjS7Ka4>
 - Tell the students to pay attention to the details of the video.
- Have the students write on the whiteboard in front of the class, one thing they learned in the video.
- Interns will then have students brainstorm ways they can help pollinators - this should take approximately 3 minutes
 - Students will do a think pair share, first thinking to themselves, then telling a partner, then explaining in groups of four
- Interns will show how the arizona-sonora desert museum has created pollinator gardens to help pollinators as well as some of the specific things they have done to make that garden effective:
 - <https://vimeo.com/262597898>
 - http://www.desertmuseum.org/center/pollinator_projects.php
- Explain that students can also plant plants that can help their own native pollinators, as well as take actions like creating their bat boxes to help out as well.

Extension Activity/Questions:

- Have the students design a garden;
 - https://northhempsteadny.gov/filestorage/16255/18642/Protecting_Pollinators_Classroom_Activity.pdf
 - http://www.desertmuseum.org/center/pollinator_projects.php
- Students will design a garden with native plants in Tucson that are important to pollinators. Interns will have their own example of their garden to show while sharing instructions.
 - Give each student a blank white piece of paper to create their own garden map.
 - Interns won't pass out colored pencils until gardens are drawn out and plants are drawn.
 - Interns will pull up a slide on the SmartBoard with pollinators and their "favorite" (plants that benefit them the most) plants as well as some other good landscaping practices.
 - They can make their garden into any shape; a circle, square, rectangle, heart, star, etc.
 - Each student will then draw each type of plant they want in their garden and write the common name next to/below/ or above it. (Names will be on the board)
 - Students can write the location of where they want their garden to be at the top of the paper, or they can name their garden.
 - Interns will reinforce that every flower needs a match of a pollinator to their flower, by reminding them what's on the board.
 - Students are welcome to draw what pollinators they wanted to attract onto their papers, although they don't have to but it's a good reminder!
 - Remind the students about why these plants are so important to pollinators.
 - Once students are finished they will have to present their garden maps to the class. Ask them to describe the location (school or home or anywhere else), what pollinators they hope to attract and why they chose the plants they did.
 - Tell the students to take their garden home to share with their families!
- Tell the students they can make their own garden filled with native plants at home to attract their favorite pollinators!

Evaluation Activity:

- Kahoot! <https://create.kahoot.it/share/protecting-pollinators/78cdad4c-e273-4e5c-87fe-f1bd999a4815>
- Have students take home their "gardens" and prototype bat boxes.