I am a Friend to Cicadas!

Name: _____

Date: _____

Science

Math

History

Music

Language Arts

More

About this Notebook

Dear Friends of Cicadas,

We are scientists who conduct research on periodical cicadas. Being an insect scientist, or entomologist, is so much fun because you get to ask questions and then go outside to look for answers. We have more questions than answers about these amazing insects!

We are very lucky to live where we do and to be able to witness this entomological treat every 13 or 17 years. Many people become scared during the emergences of periodical cicadas because they do not understand the fascinating story of these gentle and harmless insects.

This notebook will help you to become a knowledgeable and curious scientist. As a friend to cicadas, you can help us replace fear with fascination as we explore this amazing wonder of nature.

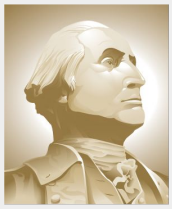
Sincerely,

Ms. Diane Lill, Director of Education, Conservation Nation
Dr. Martha Weiss, Professor of Biology, Georgetown University
Dr. John Lill, Professor of Biology, George Washington University
Dr. Zoe Getman-Pickering, University of Massachusetts Amherst
Ms. Gabriela Paola Franco Peña, Conservation Nation

Illustrations by Zoe Getman-Pickering

MEET THE SCIENTISTS IN THIS VIDEO

CONSERVATION NATION



THE GEORGE WASHINGTON UNIVERSITY
WASHINGTON, DC

Georgetown University

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Science

What is a Cicada?

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Amazing Cicada Life Cycle | Sir David Attenborough's Life In the Undergrowth | BBC

Click on the links above to watch these short videos about periodical cicadas.

What are some questions you have about cicadas? Write your questions here:

Life Cycle of Periodical Cicadas

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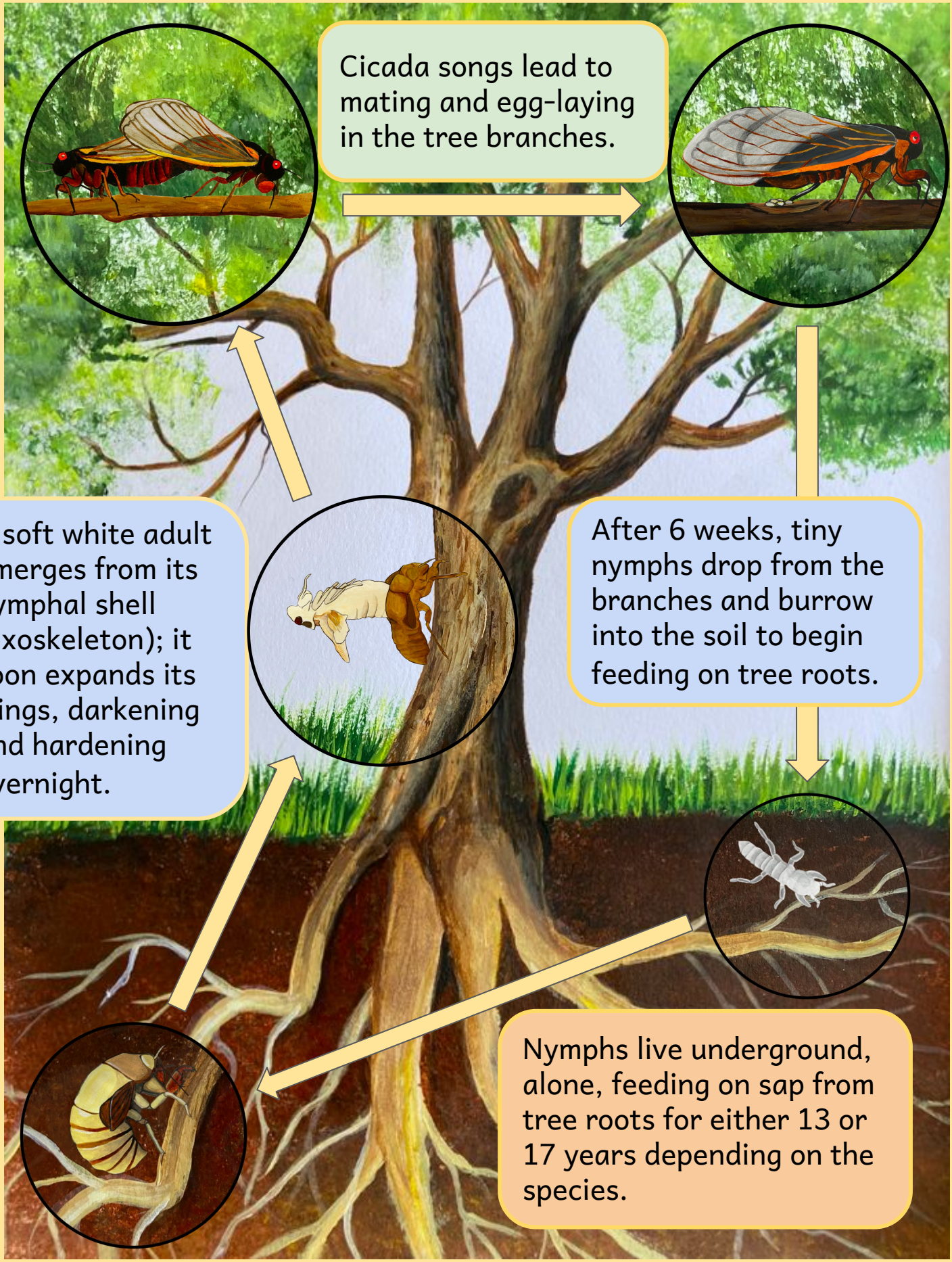

Exoskeletons

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When a nymph molts, it leaves behind its empty exoskeleton. Sometimes the exoskeletons are attached to the side of a tree or a leaf, and they look like a living insect; however, they will have a crack down the back where the adult came out, and they will not contain a living cicada. If you look closely at an exoskeleton, you can see the outlines of what will become the adult's wings, long skinny mouthparts, large eyes, and six legs. Can you see that its front legs are bigger than than others, to help the nymph to dig in the soil?

Empty exoskeletons are fun to collect!

Label the parts of the exoskeleton:

Word Bank
Abdomen
Antenna
Foreleg
Head
Thorax

Signs of Cicadas

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Photo credit: M. Raupp

Data Challenge: Estimate the density of periodical cicadas that emerged from beneath this tree. Density is measured as holes per square foot (indicated by the white square)

_____holes/ft^2

Besides exoskeletons, scientists look for a variety of other clues that indicate cicadas are present in an area, including:

- ❏ Emergence holes in the soil dug by the nymphs (above)
- ❏ Small clusters of dead leaves in trees (called 'flagging') in the summer after emergence; these indicate where the female cicadas have made their egg nests (bottom right)
- ❏ Egg nest scars on the smaller branches of trees and shrubs that healed from the wounds of egg nests (bottom left)

Cicada Data

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Record your observations about periodical cicadas here.
Your observations may include things like cicada holes in the ground, exoskeletons, nymphs, adult cicadas, choruses, flagging, etc.
An example is provided below in blue.

OBSERVATION	DATE	TIME OF DAY	LOCATION
I found 7 cicada exoskeletons on the maple tree in my backyard!	May 14, 2024	10:30 a.m.	Chicago, IL

Optional: Using the Cicada Safari Smartphone App is a great way to contribute to community science!


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Math












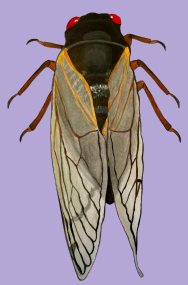


Fill in the Cicada Timeline for Brood XIII

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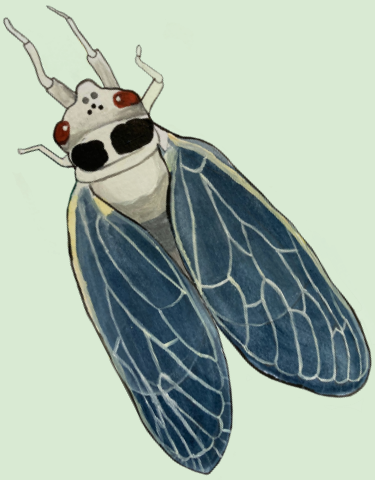
INSTRUCTIONS: The following timeline shows years of Brood XIII emergences (17-year cicadas) going back 221 years (but fossils show us that these species have been around for millions of years!). Fill in the blanks with the missing years, and add a historical fact for the year 2024:

YEAR	HISTORICAL FACT
2024	Fill in current fact: _____
	The first Apple iPhone was released
	The Americans with Disabilities Act was signed into law
1973	The Vietnam War ended
	The Last Battle, the final book in the Chronicles of Narnia, was published
	The Wizard of Oz premiered
1922	Insulin was first used as a treatment for diabetes
	The average life expectancy in U.S. was 50 years
1888	The National Geographic Society was founded in Washington, DC
	The first Major League Baseball game was played
1854	The fictional detective Sherlock Holmes was born
	The Great Depression began
1820	Antarctica is first seen by European explorers
	The last time Broods XIII and XIX emerged together



Fill in the Cicada Timeline for Brood XIX

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INSTRUCTIONS: The following timeline shows years of Brood XIX emergences (13-year cicadas) going back 221 years (but fossils show us that these species has been around for millions of years!). Fill in the blanks with the missing years, and add a historical fact for the year 2024:

YEAR	HISTORICAL FACT
2024	Fill in current fact:
	The final film of the Harry Potter series was released
	The Winter Olympics was held in Nagano, Japan
1985	The remains of the Titanic were discovered 370 miles off Newfoundland
	The first gaming console, the Magnavox Odyssey, was released
1959	Alkaline batteries were invented
	World War II ended
	A disabled engineer invented the first portable wheelchair
	The 19th Amendment was ratified, giving women the right to vote
1907	The Chicago Cubs won the World Series
	Coca-cola was sold in glass bottles for the first time
1881	Booker T. Washington opened the Tuskegee Institute
	The first Memorial Day was observed
1855	The first U.S. locomotive ran from the east coast to west coast

Cicada Calculations

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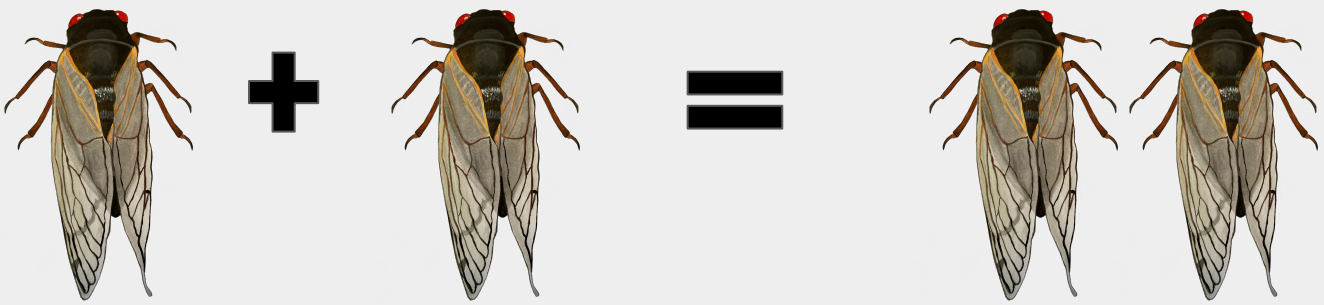
How old will you be the next time that Brood XIII emerges?	
How old will you be the next time that Brood XIX emerges?	
When is the next time that Brood XIII and Brood XIX will emerge at the same time?	
In one typical cicada emergence year, scientists noted that about 15% of the adult cicadas were eaten by birds. Estimate how many cicadas are likely to survive bird predation in a county where 10,000,000 cicadas emerge.	
How old were the cicadas that will emerge in 2024 when you were born? (Hint: They hatched in either 2007 or 2011.)	
If 150 cicadas emerge in 1 square yard, estimate how many cicadas could emerge from a patch the size of a football field (about 100 x 50 yds).	



History

Banneker's Journal

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Benjamin Banneker was a self-taught mathematician, farmer, and astronomer who grew up in Maryland in the 1700's. He is well known for his correspondence with political leaders such as Thomas Jefferson on racial equality and ending slavery. He was also a great observer of nature and he wrote the following reflection on the Brood X periodical cicadas of Maryland in one of his journals.

"The first great Locust year that I can remember was 1749. I was then about Seventeen years of age when thousands of them came and was creeping up the trees and bushes. I then imagined that they came to eat and destroy the fruit of the Earth, and would occasion a famine in the land. I therefore began to kill and destroy them, but soon saw that my labor was in vain, therefore gave over my pretension. Again in the year 1766, which is Seventeen years after the first appearance, they made a Second, and appeared to me to be full as numerous as the first. I then, being about thirty-four years of age, had more sense than to endeavor to destroy them, knowing they were not so pernicious to the fruit of the Earth as I did imagine they would be. Again in the year 1783 which was Seventeen years since their second appearance to me, they made their third; and they may be expected again the year 1800, which is Seventeen years since their third appearance to me."

SOURCE: https://core.ac.uk/download/pdf/148359244.pdf

How did Benjamin Banneker's views about the periodical cicadas change over time?

Cicadas in the News

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Read All About It!

Here are some headlines from periodical cicada emergence years:

Cicadas by the Billions Bug Residents of the East, LA Times
Midwest Bracing for Cicada Invasion, CBS News
Cicadas Swarm DC Area, GW Hatchet
Trillions of Cicadas to Plague U.S., BBC News
Those Emerging Cicadas are Giving People Anxiety, CNN

Below, list some of the headlines you can find about this year's emergence:

Think about how these headlines make you feel about cicadas. Write your own news headline that will make people curious to learn about cicadas instead of being scared:

_____

Cicadas Memories

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Interview someone who remembers a past cicada emergence and write a paragraph describing their memories, **OR**
Write a letter to future generations describing your own memories of a cicada emergence. Use the space below for your reflections:

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Music

Cicada Songs

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Listen to the sounds of various cicada species by visiting the Cicadamania.com site or listening to them in your neighborhood.

Describe or draw what the mating call sounds like to you:

Can you imitate the cicada songs? Make up a dance?

Cicada Songs

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Most of the cicadas you hear are males calling as loudly as they can to find a mate. Male cicadas have special structures on their sides called tymbals that they can move rapidly back and forth to create noise. The inside of their abdomen is mostly hollow, so it amplifies the sound even more. Males call loudly to try to attract females. Cicadas make one of the loudest calls of any insect! Click on the video below to see a tymbal in action:

TRY THIS:

To see how the tymbals work, find an empty plastic water bottle (without a top) and squash it in and out in the middle. It will make a loud noise as the plastic bends back and forth, over an empty chamber -- much like the cicada's rigid tymbal membrane, next to its hollow abdomen. What happens if you fill the bottle with water or sand? Will it still make a loud noise when you squash it? If the cicada's abdomen wasn't mostly hollow, the insect wouldn't be able to make so much noise!

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Language Arts

Language Arts

Test your knowledge!

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Cicadas are a type of _____. A cicada has _____legs and three body parts: a head, a thorax, and an _____. Cicadas are not _____. Cicadas are found in wooded areas throughout the world, but _____cicadas are only found in the eastern United States. Periodical cicadas spend most of their life _____.They have special _____that allow them to suck plant sap from tree roots. Because they feed only on plants, they are _____. A group of cicada species that emerge together in a given place is called a _____.There is an _____of cicadas in the spring every _____ or _____years. By emerging in such large numbers all at once, periodical cicadas make sure that many will escape the _____that like to eat them. About a week after emerging, _____cicadas will produce a _____ buzzing song to attract and impress female cicadas. Many males singing together is called a _____. If a female cicada hears the song of a male that she likes, she will make a _____noise in response to signal her interest. Once a male and female cicada have mated, the female flies off and lays _____of eggs in the twigs of a _____to start the next generation. Different species of cicadas have different courtship _____that are recognized only by females of the same species.

WORD BANK

abdomen	herbivores	male	six
brood	hundreds	mouthparts	songs
chorus	insect	periodical	thirteen
clicking	locusts	predators	tree
Emergence	loud	seventeen	underground

Haiku Contest

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Haiku is a Japanese form of poetry. Each poem consists of three lines that do not rhyme. The first line has 5 syllables, the second line has 7 syllables, and the third line has 5 syllables. Traditionally, writers of Haiku have focused on expressing an emotional connection to nature. The Haiku Foundation has a wonderful website with teaching tools for different grade levels that can help you learn more about this art form.

Either as a class or individually, we welcome you to compose Haiku poetry as a reflection on your experience with periodical cicadas and submit your poetry to our contest.

Snug in Silver Spring
Seventeen-year Cicadas
Sing Sarah to sleep

Underneath my feet
Feeding, growing, and waiting
Since I learned to walk

My Haiku Poem:

Click HERE to submit your poem to the 2024 Cicada Haiku Contest by **June 15**.
Winners will be notified at the end of June.
See winners from the 2021 Brood X Emergence HERE.

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And More!

Questions & Answers

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What should I do if I notice an adult or kid is scared of cicadas?
You can help your family and friends understand that cicadas can't hurt them, and they are actually super cool. Share some of the interesting facts you have learned to help others get to know cicadas better. And be patient! Sometimes adults need more help than kids to open their minds and hearts to insects.

Can I keep them as pets?
It's best not to capture cicadas or keep them as pets. They have been waiting for 13 or 17 years to reach this stage of their lives, and they should be allowed to fulfill their mission of reproducing the next generation. Instead of keeping them in a jar, why not find a spot with lots of cicadas outside where you can watch them in nature? You will get a much better understanding of how they act that way. It is okay to collect the shed exoskeletons, though!

Questions & Answers

to divider

Will the cicadas hurt the trees?
Large trees are not harmed by cicadas, though some leaves will die back. Small trees and shrubs can be damaged from the egg nests made by the female cicadas. Netting can be used to protect small trees.

What happens to all the cicadas after they die?
Many dead cicadas will be eaten by scavenging animals like raccoons, rodents, ants, and beetles. Those that aren't eaten will decompose into the soil where they will provide lots of nutrients to support growing plants. And so the cycle of life continues.

How do cicadas tell time?
We don't know! Each spring, there are chemical changes in the sap that flows from the roots up to the leaves; while cicadas can use those changes to detect that another year has passed, we have no idea how they keep track of how much time has passed.

Glossary

to divider

Abdomen - The rear-most body region of an insect.

Antennae - Long feelers on an insect's head that they use to smell and taste things.

Cicada - A type of insect that spends most of its life as a nymph underground feeding on the sap of tree roots.

Chorus - A group of many male cicadas singing together.

Emergence - The process of cicadas coming up from underground.

Exoskeleton - A rigid external covering of an insect's body that provides both support and protection.

Herbivore - An animal that gets its energy from eating plant or plant parts.

Metamorphosis - The process by which an insect changes from a young immature form to a different adult form.

Molting - The process by which juvenile insects grow, requiring them to shed their hardened exoskeleton and grow a larger one.

Nymph - The term for some immature insects that do not have a pupal stage.

Life Cycle - The series of important events that occurs in the life of a living organism, including when and where they are born, develop to adulthood, reproduce and die.

Predator - An animal that get its energy by killing and eating other animals.

Predator satiation - An anti-predator strategy in which prey, like cicadas, briefly occur at very high densities, reducing the likelihood that any one individual will be eaten and ensuring that many survive to reproduce.

Prey - An animal that is hunted and eaten by other animals.

Ovipositor - A tube-like body part through which female insects lay eggs.

Thorax - The middle region of an insect's body where legs and wings attach to the body.

Tymbal - A flexible sound-producing organ found on the abdomen of male cicadas. Males 'sing' by flexing these rigid ribbed membranes back and forth several hundred times per second.

For More Info:

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Return of the Cicadas (PBS Documentary)

Cicada Mania: Cicada Insect News, Facts, Life Cycle, Photos & Sounds

The 2024 Periodical Cicada Emergence

Our website: www.FriendtoCicadas.org

Thank you for being a friend to cicadas!

CONSERVATION NATION

THE GEORGE WASHINGTON UNIVERSITY
WASHINGTON, DC

Georgetown University