

Mosquito Alert STL: Educator Resources

Citizen Science, Mosquitoes

Purpose:

This educator guide has been created in order to encourage educators to incorporate citizen science into their units of study. Citizen science is a way for people to contribute to scientific knowledge by collecting data and uploading their findings to a database where professional scientists can then analyze it. This process allows scientists to collect information from larger areas and more quickly than they could do on their own. There are opportunities to participate in a wide range of citizen science activities. This unit will focus on learning about mosquitoes and collecting data for Mosquito Alert STL.

There are over 200 species of mosquitoes in North America. Of these, 12 species are vectors and have the potential to spread disease. There have been cases of dengue, chikungunya, Zika, malaria, and West Nile. As the spread of disease is a public health concern, it is important for the public to understand how they can help control mosquito populations and protect themselves while enjoying the outdoors. Educating students is an important step in communicating this type of information and providing an opportunity to participate in citizen science. These lessons are connected to Missouri Learning Standards.

This unit will focus on three common genera that spread disease: *Aedes*, *Anopheles*, and *Culex*.

Mosquito Alert STL is a collaborative effort among individuals from several organizations with the goal to monitor and report mosquitos in your neighborhood. By using the Mosquito Alert app to document mosquito activity, you can help health officials track and control mosquito populations, protect yourself and your family from mosquito-borne diseases, and use ecological methods to manage mosquitoes without harming beneficial pollinators.

It is our hope that incorporating these activities into your units of study will provide engaging ways for students to gain understanding of mosquitoes and share their knowledge with their families.

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Lesson 1

Mosquitoes: Biology & Life Cycle

Grades 6-8

Estimated Time: 90 minutes

Standards:

6-8 Science Missouri Learning Standards: Grade Level Expectations

Life Sciences 1: From Molecules to Organisms: Structure and Processes

Concept B: Growth and Development of Organisms (LS1.B.1)

Construct an explanation for how characteristic animal behaviors as well as specialized plant structures affect the probability of successful reproduction of animals and plants respectively.

6-8 LS1.B.2 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

Essential Questions:

What is a mosquito?

What do they look like?

How many species are there?

What is their life cycle?

Student Outcomes:

At the end of this lesson, students will be able to:

- Draw the mosquito life cycle
- Label the parts of an adult mosquito
- Describe mosquito habitats
- Identify *Aedes*, *Anopheles* and *Culex* genera and describe key factors of each genera

Materials

Blank paper

Pencils, drawing materials

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Documents, Presentations + Worksheets

- Google Slides: [What is a mosquito?](#)
- Mosquito labeling worksheet [mosquito labeling worksheet](#)

Articles

Mosquito Life Cycle - EPA

- <https://www.epa.gov/mosquitocontrol/mosquito-life-cycle>

Anopheles life cycle - CDC

- https://www.cdc.gov/mosquitoes/pdfs/anopheleslifecycle-eng.pdf?CDC_AAref_Val=https://www.cdc.gov/mosquitoes/pdfs/341482-A_FS_Mosquito_LifeCycle-ENG.pdf

Aedes life cycle - CDC

- <https://www.cdc.gov/mosquitoes/pdfs/AedesLifeCycle-P.pdf>

Culex life cycle - CDC

- https://www.cdc.gov/mosquitoes/about/life-cycle-of-culex-mosquitoes.html?CDC_AAref_Val=https://www.cdc.gov/mosquitoes/about/life-cycles/culex.html

Videos

Asian Tiger Mosquitoes - Seasonal Science

- https://www.youtube.com/watch?v=s1ED2eJ4_s0

Which Mosquitoes are “BAD”? - UF/IAS PIE Center

- <https://www.youtube.com/watch?v=Sa7HpTX0FZQ>

Optional:

- [Safari Ltd. Life Cycle of a Mosquito - Educational Toy Figurine](#)
- Book: *Mosquitoes: An Augmented Reality Experience* by Sandra Markle

Vocabulary

Parts of a mosquito:

- Head
- Thorax
- Abdomen
- Wings

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- Proboscis
- Eyes
- Legs

Mosquito life cycle:

- Egg
- Larva
- Pupa
- Adult
- Blood meal
- Larvicide
- adulticide

Instruction

1. Students will create a personal meaning map (PMM). A personal meaning map is a way to explore students' knowledge about the topic before learning about it. Students will write what they know about the topic in one color before beginning the lesson. At the end of the unit, they will use a different color to add new information they learned about mosquitoes. Students will then be given a few minutes to reflect on their learning and share with the class how their knowledge changed and any clarifying thoughts on their PMM.
 - At the start of the lesson, the teacher will give students the prompt word "mosquitoes." On a blank sheet of paper, students will use a black pen to write the word "mosquito" in the middle of the page. They will add words or phrases, or draw images they associate with "mosquito." They will set the paper aside as the teacher moves on with the lesson.
2. The teacher will provide an overview of mosquitoes using the *What is a mosquito?* Google slide presentation [What is a mosquito?](#)
3. Students will read the provided articles and watch videos to gain a fuller understanding of mosquito biology.
4. Students will label a diagram of a mosquito using [mosquito labeling worksheet](#).
5. Students will choose a genera (*aedes*, *anopheles*, or *culex*) and draw a diagram of the life cycle.

Lesson 2

What's the Buzz About Mosquitoes?

Grades 6-8

Estimated Time: 120 minutes

Standards:

6-8 Science Missouri Learning Standards: Grade Level Expectations

Life Sciences 1: From Molecules to Organisms: Structure and Processes

Concept B: Growth and Development of Organisms

(LS1.B.1)

Construct an explanation for how characteristic animal behaviors as well as specialized plant structures affect the probability of successful reproduction of animals and plants respectively.

(LS1.B.2)

Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

(LS2.C.1)

Construct an argument supported by empirical evidence that explains how changes to physical or biological components of an ecosystem affect populations.

(LS2.C.2)

Evaluate the benefits and limitations of differing design solutions for maintaining an ecosystem.

Essential Questions:

What role do mosquitoes play in the ecosystem?

Do mosquitoes cause harm to humans?

Student Outcomes:

At the end of this lesson, students will be able to:

- Explain the purpose of mosquitoes in the ecosystem

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- Explain how mosquitoes impact humans
- Explain what changes can be made to reduce mosquito populations near areas where humans live
- Design a landscape that can help control mosquito populations

Materials

Blank paper
Pencils
markers/colored pencils
Computers for research

Articles

What purpose do mosquitoes serve? - National Wildlife Federation

- <https://blog.nwf.org/2020/09/what-purpose-do-mosquitoes-serve/>

What purposes do mosquitoes serve in ecosystems? - Britannica

- <https://www.britannica.com/story/what-purposes-do-mosquitoes-serve-in-ecosystems>

Three natural ways to reduce mosquito bites - National Wildlife Federation

- <https://blog.nwf.org/2019/07/mosquitoes-suck-how-to-say-bye-to-bites-naturally/>

Gardening and landscaping resources - GrowNative!

- GrowNative! Landscape Plans <https://grownative.org/learn/native-landscape-plans/>
- GrowNative! Top 10 lists <https://grownative.org/learn/top-10-lists/>
- GrowNative! plant database <https://grownative.org/native-plant-database/>

Videos

Parasites and hosts - FuseSchool

- <https://www.youtube.com/watch?v=4j6jikayKZA>

Vocabulary

Exoskeleton
Host
Molt

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Parasite

Spiracle

Virus

Vector

Personal Protective Behavior (PBB)

Risk Communication

Instruction

In this lesson, students will investigate mosquitoes to learn about their role in the ecosystem. What place do mosquitoes hold in the food web and what impact do they have on humans?

1. Students will read the articles and watch the video to learn about mosquitoes' roles in the ecosystem.
2. Divide students into small groups. They will work together to design a landscape that will promote native wildlife and keep mosquito populations under control
3. Once their landscape is created, groups can present their designs to the class explaining their choices

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Lesson 3

Mosquitoes as vectors: Their impact on human communities

Grades 6-8

Estimated Time: 90 minutes

Standards:

6-8 Science Missouri Learning Standards: Grade Level Expectations

Life Sciences 2: Ecosystems: Interactions, Energy and Dynamics

Concept C: Dynamics, Functioning and Resilience (LS2.C.1)

Construct an argument supported by empirical evidence that explains how changes to physical or biological components of an ecosystem affect populations.

6-8 Earth and Space Sciences

Concept C: Human Impacts on Earth's Systems (ESS3.C.2)

Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Essential Question:

In what type of habitats do mosquitoes breed?

How do mosquitoes spread disease?

How can we prevent mosquitoes from transmitting viruses, such as West Nile, Zika, malaria, and Dengue, to humans?

Student Outcomes:

At the end of this lesson, students will be able to:

- Identify areas in which mosquitoes can breed
- List diseases that can be spread by mosquitoes
- Describe the health impacts of mosquito-borne diseases

Materials

camera/phone - to take photos of mosquito breeding areas

Mosquito Alert app - used by teacher or adult family member(s) in order to submit data to scientists

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Documents, Presentations + Worksheets

- Container identification worksheet [container identification worksheet](#) - to take notes about where mosquitoes might be breeding
- Common backyard mosquito sources image [common backyard mosquito sources](#)

Articles

Overview of mosquitoes - CDC

- <https://www.cdc.gov/mosquitoes/about/index.html>

Mosquito Control - CDC

- <https://www.cdc.gov/mosquitoes/mosquito-control/mosquito-control-at-home.html>

Dengue - CDC

- About Dengue <https://www.cdc.gov/dengue/about/index.html#print>
- Dengue in the US <https://www.cdc.gov/dengue/areaswithrisk/in-the-us.html>

West Nile - CDC

- WNV overview <https://www.cdc.gov/westnile/index.html>
- Data and maps <https://www.cdc.gov/westnile/statsmaps/current-season-data.html>
- WNV transmission cycle
https://www.cdc.gov/westnile/resources/pdfs/13_240124_west_nile_lifecycle_birds_plainlanguage_508.pdf

Zika - CDC

- Overview <https://www.cdc.gov/zika/about/index.html>
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Videos

Why the threat of mosquito-borne diseases is on the rise - PBS

- <https://www.pbs.org/video/threat-of-mosquitoes-1700344142/>

We could kill all mosquitoes (but should we?) - DW Planet A

- <https://www.youtube.com/watch?v=xAPjCSN0tRs>

Vocabulary

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Vector

Virus

Instruction

Students will explore outdoor spaces around the school and where they live to determine if there are areas where mosquitoes are likely to breed.

1. Divide students into groups, with each group focusing on a different disease. Each group will read the Overview of mosquitoes and Mosquito control articles.
2. They will then read the articles focusing on their assigned disease.
3. All students will watch both videos.
4. Students will take notes highlighting key facts they learn about mosquitoes and the diseases they spread.
5. Come together as a whole class to look at the image
 - a. Present the [Common backyard mosquito sources](#) image
 - b. Have students identify the areas where mosquitoes may breed
 - c. What are some areas at school that they should look for?
6. Pass out copies of the [container identification worksheet](#)
 - a. The class can work individually or in small groups to explore school grounds
 - b. Students who have phones (or they can use school devices) to take photos of areas where mosquitoes can breed.
 - c. Fill out the worksheet to document these areas
 - d. Students may also take pictures for the teacher or another adult to submit to the Mosquito Alert app

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Lesson 4

Learning About Citizen Science

Grades 6-8

Estimated Time: 45 minutes

Standards:

6-8 Science Missouri Learning Standards: Grade Level Expectations

Earth and Space Sciences: Human Impacts on Earth's Systems (ESS3.C.2)

Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Essential Questions:

What is Citizen Science?

What value do citizen scientists provide to the scientific community?

How does citizen science help mosquito research?

Student Outcomes:

At the end of this lesson, students will be able to:

- Explain how citizen science works and why it is important
- Explain what data can be submitted to Mosquito Alert and how to submit it
- Add new knowledge to their personal meaning map and reflect on their learning

Materials

Articles + information sheets

- Mosquito Alert STL website
<https://www.missouribotanicalgarden.org/sustainability/sustainability/biodiversecity-st-louis/mosquito-alert-stl>
- Mosquito Alert STL fact sheet
https://www.missouribotanicalgarden.org/Portals/0/BiodiverseCity/PDFs/mosquito-alert/mastl-partnership-kit_july2023.pdf?ver=kDPLKvBeLRSI7KLxm90DTQ%3d%3d
- Students personal meaning maps from the first lesson

Videos

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What is citizen science - Science North

- <https://www.youtube.com/watch?v=UrvzCAWaQ80>

Vocabulary:

- **Community Science:** “a collaboration between professional scientists and members of the general public involving the collection and analysis of data relating to the natural world. Community science provides tremendous value to professional scientists, while also engaging enthusiasts in scientific subject matter.”

Examples of citizen science

- iNaturalist <https://www.inaturalist.org/>
- Missouri Bumblebee Atlas <https://www.bumblebeeatlas.org/>

Instruction

In this lesson students will learn about citizen science, including who can participate, the goals of citizen science and how data is collected and reported.

1. Students will spend time looking at the Mosquito Alert STL website and fact sheet to learn more about the program and watch the video on citizen science. Students will take notes on what they learn, writing down 3 or more ways citizen science can help scientists.
2. Teacher will bring students together for a whole group discussion. Students will share what they learned and have an opportunity to ask clarifying questions.
3. Students will fill in new knowledge they acquired about mosquitoes on their PMM. They will use a different color pen or pencil and add words or pictures to represent their learning. Allow students about 5-10 minutes to fill in their PMM. They can then share their learning in small groups or as a whole class.

Final Project: Commercial or advertisement creation

Grades 6-8

Estimated Time: 2-5 meetings of 45 minutes each

Standards: Speaking and Listening

Grade 6: Plan and deliver appropriate presentations based on the task, audience, and

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purpose including multimedia components in presentations to clarify claims, findings and ideas.

Grade 7: Plan and deliver appropriate presentations based on the task, audience and purpose including multimedia components in presentations to clarify claims and findings and emphasize significant points.

Grade 8: Plan and deliver appropriate presentations based on the task, audience, and purpose integrating multimedia into presentations to clarify information, strengthen claims and evidence, and add interest.

Essential Questions:

What information do people need to know to protect themselves against mosquito-borne viruses?

How can I create visual media to share important information about mosquitoes, their role in the ecosystem and ways to reduce their impact on human health?

How can I encourage others to use the Mosquito Alert app?

Student Outcomes:

- Students will develop a commercial or create an advertisement to share what they learned about mosquitoes, promote citizen science and usage of Mosquito Alert STL

Materials

Poster paper

Pencils, markers, crayons, colored pencils

A recording device (ipad, cell phone, video camera, etc.)

Editing software

Instruction:

1. Divide students into small groups
2. They will determine if they will create an ad or a commercial
3. Provide students time to storyboard their project
4. Allow 2-5 class meetings (45 min. each) for students to work and create their project
5. Each group will present their project to the class
6. Share projects with families and community members to provide information about mosquitoes and Mosquito Alert STL