Identifying and Mapping Local Habitats

In this task, the team will identify potential mosquito habitats in and around your research site. The team should look for both human and natural potential habitats. Opportunities to engage in the Citizen Science program GLOBE Mosquito Habitat Mapper are provided. Participate if you can.

In this task, the team will be focusing on the following questions from the question map.

- Where do mosquitoes live and breed?
- What influences this?

1. Go to the Task 5-2 folder and get the Identifying and Mapping Local Habitats instructions and GLOBE. You will also need your research map from Task 2-1. There are two versions of this task. Mosquito A involves collecting data by hand. Mosquito B involves using the Citizen Science GLOBE Mosquito Habitat mapper app. Choose the version that works for you. It might also be helpful to do both if you can. In that case, start with Mosquito A and then do Mosquito B.

2. As a team, read the Meet the Team reading.

3. Conduct a research site evaluation.

4. As a team, discuss the following.
   - How could your habitat survey of your research site be useful when thinking about where mosquitoes live and develop in your local community?
   - How could this information be useful when thinking about the problem question: How can we ensure health for all from mosquito-borne diseases?
   - How could this information be useful when developing solutions to manage mosquitoes in your local community?
   - Changes in habitats can affect mosquitoes in your local area. How could you monitor habitat changes in your research site in the future? How could this information be useful to address the problem question in the future?

Continue to Task 5-3
Task 5-2
Tutorial
Mosquito Habitat Mapper
Overview

This presentation:

• Provides background information to prepare citizen scientists to use the GLOBE Observer Mosquito Habitat Mapper

• Provides the step by step instructions for obtaining a mosquito sample for analysis
Overview

Learning Objectives

After reviewing these slides, you will be able to:

• Recognize potential mosquito breeding sites
• Sample water for mosquito larvae
• Identify mosquito larvae and differentiate between *Aedes*, *Anopheles*, and *Culex* larva.
• Understand the importance of removing extraneous containers with standing water from around your neighborhood and community
**GLOBE Observer** is an international network of citizen scientists and scientists working together to learn more about our global environment, including our changing climate and its impacts.
GLOBE Observer is part of The GLOBE Program. Data collected by citizen scientists through GLOBE Observer encourages student research, strengthens science education, and supports the work of scientists.

**GLOBE Stats**

117 Countries  
30,776 Schools  
28,193 Teachers  
141,856,866 Measurements  
518,056 Measurements this month
• The goals of the MHM app are to **SEE** increased mosquito awareness and decreased mosquito-borne disease risk through:

  • **Scientific data collection and analysis:** Identifying locations of mosquito taxa of interest to participants, communities, public health authorities
  
  • **Empowerment:** Actively reducing mosquito risk- by dumping containers and monitoring environment
  
  • **Education:** Learning opportunistic breeding habits used by *Aedes aegypti/albopictus* in human built environments and about vector borne disease risk communities
Our investigation focuses on mosquito larvae - an immature developmental stage that lives in water, doesn’t bite and doesn’t pose a health hazard to humans!
The Mosquito Habitat Mapper supports you through **4** data collection steps:

1. **Locate**
2. **Sample/Count**
3. **Identify**
4. **Decommission**
Equipment Needed for habitat mapping and sampling:

- **GO Mosquito Habitat Mapper on a mobile device (e.g., phone or tablet)** for recording and submitting data.

- **Mosquito dipper, ladle, cup or bulb syringe (or a net, bucket, and wash bottle)** for sampling. (Contact your local mosquito control authority for any recommendations)

- **Plastic bag and marker** for saving or transporting water samples with larvae and labeling the bag.
Equipment needed for Identification

• **Macro lens** attachment for mobile device (35x) or microscope. (Some features can be seen with a good magnifying glass.)

• **Toothpicks, tweezers or forceps** to move larvae for viewing

• **White plastic or paper plate**

• **Paper towels**

• **Ethanol** for euthanizing specimens or preserving samples (optional)

• **Plastic or glass vials** for specimen storage (optional)
Citizen Scientist Safety

Note: most mosquitoes do not transmit pathogens to humans or cause disease.

- **Protect against mosquito bites:**
  Wear long sleeves, pants, socks and shoes.
  Apply an effective insect repellent to exposed skin.

- **Protect from polluted or unsafe water:**
  Wear gloves and/or goggles.

- **Avoid sampling on private property:**
  Sample in your own yard or in public areas. Do not take samples on private property unless you have obtained permission.

  ✔ Recommended: goggles and gloves for safety
Data Collection using the GO Mosquito Habitat Mapper
Step 1. Locate Breeding Sites

Open GLOBE Observer Mosquito Habitat Mapper.

The app will automatically download the date, time and the latitude / longitude of your location.

You will be able to verify the location by the map that is provided.

Note: You can use the app whether or not there is Wi-Fi at your sampling location. All recorded data will automatically be sent when Wi-Fi becomes available!
Locate sources

Locate sources of standing water. Check the surface of the water for mosquito larvae.
Step 2: Sample and Count

Use your sampling tool (whether a cup, syringe, dipper, net/wash bottle) to obtain a water sample containing larvae.

Protocols for gathering samples vary according to the tool used. Use the one that works best for your situation.
**Importance of taking multiple dips**

But no matter which tools you use, GLOBE recommends sampling each source 5 times. Because the larvae are not evenly distributed on the surface, so you may need several dips to obtain a sample with larvae in it.

Wait a couple minutes between each dip. Why? When you disturb the surface of the water, the larvae will swim below for safety. However, they will soon return to the surface because they have to breathe.

Technique for using a net or a mosquito dipper in a small pond
Sampling Method 1: Bulb Syringe

This method is appropriate for all environments and sampling sites.

Steps:
1. Press and collapse bulb.
2. Place syringe tip near the top of the water surface.
3. Release bulb so bulb inflates and water enters the syringe.
4. Transfer sample to plastic bag by holding tip and then releasing the sample into the bag.
Sampling Method 2: Dipper

You can use a mosquito dipper, a soup ladle, or even a plastic cup when sampling either a container or a non-container site.

Steps:

1. Skim the upper most surface of the water with the dipper at an acute angle with respect to the water surface.

2. Transfer your sample to a sample bag. (You can put all your samples in the same bag.)
Sampling Method 3: Net sample from large container

Large water containers are those that hold 500 L or more of water. Examples include large water jars, water pools, and cement tanks.

Steps:
1. Dip the net in at the surface of the water.
2. Start at the top of the container by swirling the net around the edge.
3. Continue to the bottom in a swirling motion- sampling all edges of the container.
Sampling Method 4. Net sample from small container

Steps:

1. Pour water from the container holding the sample through a collection net into a separate bucket.

2. Use a squirt bottle filled with water to wash any trapped debris into the bucket.

3. Pour sample from bucket into a plastic bag(s).
Handling Samples

• You may want to take your sample inside to identify your specimen

• Leave air in bags so that larvae can breathe.

• Keep bags cool and in the shade (overheating will kill larvae).

• Identify the larvae soon after collection. If left overnight, any pupae in the sample may become adult flying mosquitoes.

• If you find adult mosquitoes in your sample bag, shake the bag to drown the adult mosquitoes and dispose of the sample by pouring all contents on the ground.
Step 2: Sample and Count

Count the number of larvae in your sample. You can provide an exact number or an estimate.

For example, in the sample to the right, the larvae count is estimated to be 75-100.

Using this same sample photo, it is important to note that not all of the larvae look the same. Why do you think they are different?
(Answer)

This sample has larvae from different stages of development.

We will show you what we mean in the next few slides.
After hatching from its egg, the larva is in its first instar (stage between molts). It eventually outgrows its exoskeleton and molts (loses its outer covering) to become a second instar. It does this two more times to reach the fourth instar. The fourth instar is the larval stage that is most visible, reaching a length of one-half inch.
The features used to identify your specimen are seen on the **4\(^{th}\) instar larva**—so look for the biggest larvae in your sample. If you can’t distinguish any features, it is possible that the larvae are still in an earlier instar stages. If that is the case, you can count your larvae, but you will not be able to identify features.
The 4th instar will molt to become a pupa, another stage in the lifecycle of a mosquito. Pupa are distinguished by their appearance- they look like a comma. You may find pupae in your sample.
Step 3. Photograph and Identify-1

In order to examine and photograph the larvae, they must be removed from the bag.

To begin:
• Pour part of the sample containing larvae onto a white tray or plate.
Photograph and Identify-2

• Use a dropper or spoon to isolate one larva.

• Make sure each larva is suspended in a small drop of water.
Photograph and Identify-3

It is important that the drop of water just covers the larva. Too much water will allow the larva can swim- making it difficult to examine and photograph.

You can remove most of the water by blotting it up using the corner of a paper towel.

If the larva is still moving too fast to see, you can euthanize it with a drop of alcohol.
Photograph and Identify-4

- Use a probe or toothpick to position the larvae so you can see the diagnostic features.
Attach a macro lens to a mobile device so that you can take a picture and upload it to the app.
• Clip the macro lens over the lens of the camera and line it up so that you see a perfect circle of light on your phone screen.
• Line up the lens so that the specimen is in the circle of light on the viewer.
Photograph and Identify-8

Note that many clip-on devices have a clear collar on them at the end of the lens. You can rest the collar of the lens on your plate.

The collar helps you find the focal length that is ideal for looking at your specimen.
**Photograph and Identify-9**

Once you have a mosquito larva in view, closely examine the diagnostic features.

Now you are ready to identify your specimen. Use the MHM app or a local mosquito larva key to determine the types of mosquitoes in your sample.

Submit photograph and identification to MHM, following instructions in the app.
Photograph and Identify-9

If the larvae you found are “other,” it is probable you have found one of the many mosquitoes that play an important role in the ecosystem. These mosquitoes are occasionally referred to as “nuisance” species, with respect to humans, but they also serve as food for other organisms and as pollinators for plants.
Step 4: Decommission the breeding site

Where possible, decommission (eliminate) container breeding sites by:

• Tipping the container and tossing the water
• Covering the container
• If you locate a breeding site that you can’t or shouldn’t decommission by yourself, contact a public health official.
• Don’t worry about removing a breeding site from use unless it is a natural or artificial container. Birds, frogs and other living things will thank you!
Visualize and Retrieve Data-1

GLOBE provides the ability to view and interact with data measured across the world. Use our [visualization tool](#) to map, graph, filter and export data that have been measured across GLOBE protocols since 1995. The Mosquito Protocol is new- so we look forward to seeing your data!

[Link](#) to step-by-step tutorial on using the GLOBE Data Visualization Tool
Visualize and Retrieve Data-2

Select the date for which you need pH data, add layer and you can see where data is available.
Additional educational materials for formal and informal education contexts

Educational Resources
Training Protocols
Games
Frequently Asked Questions (FAQs)

What is the mosquito life cycle?
It is variable, based on species and environmental conditions - so this is approximate!
Adult → eggs (2 - 3 days) → larvae (4 - 5 days) → pupae (1 - 2 days) → Adult

How do you differentiate between the Anopheles, Aedes or Culex larvae (identify with unaided eyes)?
We can see the characteristics of mosquito larvae: In the water, Anopheles larvae cling parallel with the water surface. On the other hand, Aedes and Culex larvae cling at an angle of 45° with the side of the container. Aedes larvae have shorter siphons, Culex larvae tend to have longer siphons. However, there are 3,500 species of mosquitoes, so you should consult a key for your area to be sure.

What do adult mosquitoes feed on?
Adult mosquitoes feed on any sugar source, including flowers, fruit, nectar and other insects. Some mosquitoes are important pollinators, like bees!

At what time of the year are greater percentages of mosquito larvae found?
Most often they are found in the rainy season or shortly after the end of the rainy season.
When should I use the GLOBE Observer App or the GLOBE Data Entry App to enter my data?

If you are going to also conduct water quality measurements at the same time or return to the same study site periodically, you will want to follow the GLOBE Mosquito Larva Protocol and GLOBE Data Entry App. This will allow you to look at mosquito density and population change in conjunction with other environmental variables at your GLOBE Hydrosphere study site.

The GLOBE Observer Mosquito Habitat Mapper is designed to support identification of breeding sites around your neighborhood and school, especially those that are in containers. Where possible you will be removing the opportunistic breeding site from use by dumping the container and removing trash. This reduces risk of disease in communities. For some sites, you may be returning to the site- such as a water storage container or drain- but these sites do not need to be identified as GLOBE Hydrosphere study sites.
Acknowledgements

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The **Mosquito Challenge Community Campaign (MCCC)** is focused on demonstrating the usefulness of citizen science data collected using the GO Mosquito Habitat Mapper for combating Zika in Brazil and Peru. MCCC is led by IGES in partnership with the University Corporation for Atmospheric Research (UCAR), and leverages the NASA App, and the GLOBE Program networks of scientists, teachers, students, and citizen scientists. The MCCC project is made possible through the generous support of the Combating Zika and Future Threats Grand Challenge through the United States Agency for International Development (USAID).

This presentation was prepared by the Institute for Global Environmental Strategies (IGES) and does not necessarily reflect the views of the NASA or USAID.

Educators: If you modify these slides for your own use, please retain this last slide and put your name and contact information below, thank you!

For more information, contact the MCCC PI, Dr. Russanne Low, IGES, [rusty_low@strategies.org](mailto:rusty_low@strategies.org).
[www.globe.gov](http://www.globe.gov)
Task 5-2 Identifying and Mapping Local Habitats—Mosquito A

Instructions

- Listed below are some places where you might find mosquito eggs, larvae, and/or pupae in your research site.
- Look in your research site for each item in the list and check it for water. If you find any water, describe it and then collect what you find for research purposes, or dump it out so the mosquito eggs, larvae, and pupae cannot grow there.
- Document on your research map the location of each mosquito habitat.

<table>
<thead>
<tr>
<th>Habitat</th>
<th>Number found</th>
<th>Found water in habitat (yes or no)</th>
<th>Description of water clarity (clear to dirty)</th>
<th>Description of water movement (still or stagnant to fast-moving)</th>
<th>Habitat exposure (sun, shade, semi-shade)</th>
<th>Found eggs, larvae or pupae in water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cans, bottles, jars</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Pots and containers for flowers or plants</td>
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<tr>
<td>Old tires</td>
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<tr>
<td>Bird baths</td>
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<tr>
<td>Roof gutters</td>
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<td></td>
</tr>
<tr>
<td>Drainage pipes around buildings</td>
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<td></td>
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<tr>
<td>Trash</td>
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<td></td>
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<tr>
<td>Item</td>
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<td>4</td>
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<tr>
<td>Tarps, plastic bags</td>
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<tr>
<td>Old cars</td>
<td></td>
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<td></td>
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<tr>
<td>Boats, canoes</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Dripping outdoor faucets or window air conditioners</td>
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<tr>
<td>Wheelbarrows</td>
<td></td>
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<tr>
<td>Garbage cans, recycling bins, other barrels</td>
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<tr>
<td>Low spots on ground</td>
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<tr>
<td>Tree stumps</td>
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<td></td>
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<tr>
<td>Tree holes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rain barrels</td>
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</tbody>
</table>
Task 5-2 Identifying and Mapping Local Habitats—Mosquito B

Citizen Science Project Instructions

- Below are some resources to help you take part in the GLOBE Mosquito Habitat Mapper app citizen science project. You will need a smartphone or tablet to do this. Use the resources in the Learning Lab task folder to learn more about the app, how to use it, and how to collect data about your research site.
- Look in and around your research site for various potential mosquito habitats and check it for water. If you find any water, describe it and then dump it out so the mosquito eggs, larvae, and pupae cannot grow there. Follow the instructions in the app.
- If you’re able, identify any mosquito larvae found.
- Document on your research map the location of each mosquito habitat.

GLOBE Mosquito Habitat Mapper App Resources

To get the GLOBE Observer app (includes mosquito habitat mapper):
https://observer.globe.gov/about/get-the-app

Look over the GLOBE Mosquito Habitat Mapper App Overview and Instructions PowerPoint.

View the video resources about the GLOBE Mosquito Habitat app in Learning Lab:
http://learninglab.si.edu/q/ll-c/RW29tFCHPHv9tjDB
Rusty Low - Senior Earth Scientist - Institute for Global Environmental Strategies

I have focused on many different things in my research and career. However, there has been a theme throughout. This theme concerns how humans and societies address the impact of and are impacted by the environment and climate change.

I am interested in how the climate is changing. We are now learning that mosquitoes and other disease vectors are responding to these climate changes. Climate changes are causing mosquitoes to expand their habitats. It is also causing them to invade new areas. Many of these are areas they have not been found in before.

I read about the history of mosquitoes and the efforts to eradicate disease in places like the United States at the turn of the century. There are many success stories, all before we had pesticides to kill mosquitoes. So I wondered if we could use the power of the “crowd in the cloud” to better get a handle on the transmission of diseases like Zika and dengue.

There are not enough pesticide to cover the entire world. We are also learning about pesticide resistance. In many places we have already tried managing mosquitoes, with serious consequences to the environment. So I wondered if local monitoring could have a role in better identifying areas prone to disease.
I know that cities with many resources have mosquito control teams. Many of these teams do a terrific job of monitoring their community. However, I was wondering about the areas that do not have the money, people, or resources. Many of these communities are not prepared or do not have the money for mosquito control. Many times these places have had mosquito problems before.

So we started to build the GLOBE Observer Mosquito Habitat Mapper app. It is an app for smartphones and mobile devices. The app allows kids and adults to locate sites in their community that mosquitoes might like. People can share this information with one another. Then they can find out if the mosquitoes are the type that transmit diseases. The data are shared with the science community to help make decisions around the world. It is a fun way to use science to make a difference locally!

Building the app has been interesting work. I like working on a team. Our core team includes scientists in Colorado, Kansas, and New York City. We have program managers at NASA and computer programmers to build the app in California. We then work with communities in Brooklyn (New York) and New Orleans, USA, and in Barbuda to test the app concept. Then we work with communities in Brazil and Peru to test the app in the field.

Be creative and think about how you could use this technology to help your community, now and into the future!
Videos for Task 5-2

GLOBE Mosquito Habitat App Overview Video
Description:
This is a good overview video of the citizen science project using the GLOBE Mosquito Habitat App.
https://youtu.be/CupKTIql1vc

GLOBE Mosquito Habitat App - Classroom Example
Description:
This video shows a team working together using the GLOBE Mosquito Habitat App to collect information about their research site and share it using the app. Watch this to get ideas for how you can engage in this citizen science program if you have the resources.
https://youtu.be/ENoalx26Llk

NASA Using Satellite Data