1-6 Defining the Research Problem

You now have a better understanding of your personal and team's identity and knowledge about mosquitoes. That information will be useful as you begin to define the mosquito problem in your local community. So keep those identity maps safe for later use.

Objective

In this task, the team will meet some researchers who study the mosquito problem to learn more about different parts of the problem. These researchers will give the team some ideas about the things you should consider when doing research in your local community.

1. Go to the Task 1-6 folder to get the instructions and readings.
2. Watch the videos if you can. Do not worry if you are not able to.
3. As a team, read the Problem Introduction together.
   - During the reading, circle or underline all the words you do not understand.
   - Do not worry, there are many big words in science.
4. As a team, make a list of all the words people circled or underlined so we can start to help each other better understand them all.
5. Make a plan for how we could learn more about what these words mean.
   - Where could we search or whom could we ask to learn more about these words?
6. Go back and identify a Very Important Part (VIP) from the reading.
7. Share these VIP's as a team.
8. Follow the instructions for the Meet the Team - Jigsaw Part One.
9. Have each group present their researcher to the team, including:
   - Name, job title, organization
   - Most interesting thing from their identity map

1-6

- One VIP from each of the three questions
- Make a list of the VIPs from all groups

Follow the instructions for the Meet the Team - Jigsaw Part Two.

10. Have each group present their researcher to the team, including:
    - VIP for each perspective (ethical, economic, social, environmental)
    - VIP for why it is important to consider perspectives when making decisions about this problem
    - Make a list of the VIPs from all groups

To help your local community, we will need your team to create a research site and develop a variety of suggestions for solutions to this question:

How can we ensure health for all from mosquito-borne diseases?

Just remember, research is not always easy. There is not one right answer.

There are many possible solutions. So, you might get confused.

You might get frustrated. Things might not always work out the way you thought.

This is normal. All you can do is try again, start over, ask a different question, talk to a different person, or create a new pathway.

Just remember, there are many questions to consider. There are many decisions to make. There are many possible solutions.

Hooray! You completed Task 1-6. Check it off the task list. *Go to Task 1-7!*

Task 1-6 Defining the Research Problem

Introduction Videos

If the team is able to watch a video, start with one of the videos in the Learning Lab Task 1-6 folder. Do not worry if you are not able to watch videos. You can go straight to the reading.

Problem Introduction

Mosquitoes are all around us. Mainly during the warmer season, their constant buzzing follows you when you step outside. They leave itchy red bumps on your skin. They buzz in your ear when you sleep. They are unavoidable and annoying.

In addition to being annoying, some female mosquitos feast on your blood—most of the time without you noticing. In some places, a sleeping human can be bitten many times in a night without noticing. Female mosquitos need the blood to make eggs. These eggs grow into more mosquitoes. More mosquitoes mean more buzzing and more blood sucking. These mosquitoes are good at surviving around humans.

However, itchy bumps and annoying buzzing are not the only problems. Mosquitoes are very good at carrying and transmitting some diseases. Sometimes, when mosquitoes suck on your blood, they also inject a pathogen that transmits disease to your body. The diseases they carry are called mosquito-borne diseases. You may have heard of these diseases. They include malaria, dengue fever, Zika, West Nile virus, yellow fever, chikungunya, and encephalitis.

There are many people interested in studying and learning more about mosquitoes and the diseases they spread to humans. Let us meet some of these people to learn more about the mosquito problem.

Meet the Researchers: Jigsaw Part One Instructions

1. Divide the group into six groups.
2. Assign each group one of the team member profiles from the Meet the Team reading. The profiles are Rusty Low, Meera Venkatesan, David Pecor, Kelly Bennett, Bridget Giles, and Lee Cohnstaedt.
3. Each group is responsible for reading about one researcher.
4. When reading, complete the following in each group.
    a. Each group member should read the first page about their researcher to themselves.
    b. Have one group member read the entire reading out loud to the rest of the group.
    c. Each group member should go back and identify a Very Important Part (VIP) from each section of the first page.

i. Identify one thing on the researcher's identity map you find most interesting.
ii. Why is the mosquito problem such an important issue for people to understand?
iii. Briefly describe the researcher's work on mosquito-borne diseases.
iv. How much is still not known about mosquitoes and mosquito-borne diseases?

d. Circle or place a sticky note on what each group member thinks is the most important part of the reading.
e. In your group, have each person share their VIPs with the group and their reasons for selecting them and the item on the researcher's identity map.
f. As a group, summarize the VIPs from your group and your thoughts on the identity map.
g. Make sure each group member is ready to share their VIPs with the rest of the team.

Meet the Researchers: Jigsaw Part Two Instructions

1. Each group is responsible for reading the second page about their researcher.
2. When reading, complete the following in each group.
    a. Each team member should read the second page about their researcher to themselves.
    b. In each group, have one group member read the entire reading out loud to the rest of the group.
    c. Each group member should go back and identify a Very Important Part (VIP) from each section of the second page.
        i. Identify one VIP from each perspective (Ethical, Economic, Social, Environmental)
        ii. Why is it important to consider various perspectives when making decisions on the problem question: How can we ensure health for all from mosquito-borne diseases?
    d. Circle or place a sticky note on what each group member thinks is the most important part of the reading.
    e. In your group, have each person share their VIPs with the group and their reasons for selecting them.
    f. As a group, summarize the VIPs from your group and your thoughts on the four perspectives.
    g. Make sure each group member is ready to share their VIPs with the rest of the team.

Go back to Research Guide now

Organization:
Institute for Global Environmental Strategies

What is on Rusty's identity map?

LIKES TO SLEEP OUTSIDE.

SPEAKS FIVE LANGUAGES.

LIVED IN SIX COUNTRIES.

LIKES BIG DOGS.

PLAYS MANDOLIN.

FASCINATED WITH OLD THINGS.

LIVES IN THE MOUNTAINS.

ENJOYS LOOKING IN A MICROSCOPE.

WENT TO SCHOOL IN CANADA, GERMANY, AND U.S.

ENJOYS KAYAKING AND CROSS-COUNTRY SKIING.

NAMED AFTER GRANDPARENTS.

Compare it with yours!

Mosquito! Task 1-6 Defining the Problem

RUSTY LOW

SENIOR EARTH SCIENTIST

Why is the mosquito problem such an important issue around the world?

Mosquitoes are the most dangerous animal on the planet for humans! Mosquito-borne diseases affect half a billion people every year. Mosquito borne diseases kill up to a million people every year. Climate change is now affecting where some mosquitoes can live. These changes mean some mosquitoes and diseases move into new places. Many of these places have not had mosquito or disease problems recently. We have learned that all places must be prepared for this problem in the future.

Provide a brief description of your work on mosquito-borne diseases.

I have been working on developing the GLOBE Observer Mosquito Habitat Mapper. 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 is 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!

How much is still not known about mosquitoes and diseases in your field of work?

We still do not know many things about mosquitoes. That means there are many opportunities for citizen scientists like you. We need your help to conduct local research. This research will help us all better understand mosquitoes. It will also help us know where they live. Most of our understanding of mosquitoes comes from laboratory research. This is why we need the help of teams like yours. We need teams around the world to come together. We must share information about what is happening outside of the laboratory. We must share what is happening in our local communities. This will help us all learn more about this problem.

Why is it important to look at the mosquito problem from different perspectives?

Ethical

We must think about the ethical parts of the mosquito problem. "Ethical" means the fairness of something. Is it okay that some people are at greater risk from mosquitoes than others? Is it okay that because of factors out of their control, they are at more risk? These are all questions we must ask.

Economic

We must think about the economic parts of the problem. "Economic" is concerned with money, income, and use of wealth. Citizen scientists like you can provide economic support in your community. Many communities do not have the money to have good mosquito surveillance. The data from citizen scientists like you can help authorities make tough decisions - for example, decisions about where to spray expensive insecticides to keep mosquitoes away.

Social

It is important to consider the social part of the problem. "Social" is concerned with the interaction of people in a community. People must work together to create and maintain protection from mosquito-borne diseases in the community. Do some people have a greater risk of disease? Why or why not? These are questions we must ask.

Environmental

It is important to understand the environmental parts of the problem. "Environmental" is concerned with the natural world. It is also concerned with human impacts on the natural world. What things can help mosquitoes reproduce? How can we identify these things? How can we use this information to reduce disease risk in the community? These are questions we must ask.

Why is it important to consider a problem from various perspectives (social, ethical, environmental, economic) when making decisions and developing solutions to problems?

I was trained as an Earth system scientist. System science looks at the connections between different parts of a larger system. For example, climate change is a large system. It cannot be understood without looking at how the changing climate affects the different parts. Some of the parts are the ocean, living things, the land, and ice. You must look at the connections of these parts to have a better picture of the whole system.

We also live not only in our physical environment, but in our social one. When considering a problem, we need to think about the social and environmental parts of the problem. It is very hard to predict the outcomes of changes in either part. This is why models are so useful to scientists and social scientists. When you are trying to solve problems, you need to think about each part and how the parts all work together.

Mosquito! Task 1-6 Defining the Problem

MEERA VENKATESAN

MALARIA TECHNICAL ADVISOR

Organization:

President's Malaria Initiative, United States Agency for International Development (USAID)

What is on Meera's identity map?

SISTER.
FAMILY FROM INDIA.
FRIEND.
VEGETARIAN.
CHOCOLATE LOVER.
STUDENT.
SCIENTIST.
LOVE TO READ.
FROM CALIFORNIA.
LOVE TO COOK.
WIFE.
CURIOUS.
AUNT.
TRAVELER.
EMPATHIC.

Compare it with yours!

Why is the mosquito problem such an important issue for people to understand around the world?

The mosquito is the most dangerous creature on the planet. It causes thousands of deaths. It also makes people, often children, very sick. Even if it is not a problem where you live, it can still have a huge effect on people. One thing we have learned recently is that mosquito-borne diseases can occur anywhere. They also move quickly across the world - even into places we did not think mosquitoes could survive. Sometimes, diseases like Zika or chikungunya emerge in places they were not seen before. So, we all must prepare for the future.

Provide a brief description of your work on mosquito-borne diseases.

I work on improving the control of malaria. Malaria is the most deadly mosquito-borne disease. Malaria kills around 500,000 people per year. Most of these deaths are kids living in Africa. Luckily, we have many tools to fight malaria that work. The task now is getting them to people in need. We also need them to be used by people at risk. These tools include:

- Tests to know when you have malaria
- Treatments that help sick people
- Bed nets to sleep under
- Spraying insecticides on the walls of homes to keep mosquitoes away

I work at USAID for the President's Malaria Initiative. My work helps countries in Africa and Asia. My work helps these countries with their own local malaria control programs.

How much is still not known about mosquitoes and mosquito-borne diseases in your field of work?

Many mosquito control projects are growing in Africa and Asia. However, there is still a problem of the "left over" spread of disease. Mosquitoes that still live in a place can cause problems. Mosquitoes that are resting and biting outdoors where people are not protected can cause problems. The malaria research community is working hard to figure out how to target these mosquitoes. They are also working hard to learn how to protect people from being exposed to infected bites. Exposure can happen when working, sleeping, or spending time outside. This is where we need the help of teams like yours. When teams come together, we can learn more about this problem. This will help us create solutions that work better for different communities.

Why is it important to look at the mosquito problem from different perspectives?

Ethical

We must think about the ethical parts of the mosquito problem. "Ethical" means the fairness of something. First, we must not ignore the people who are at great risk from mosquito-borne diseases. These people may be the hardest to reach or get involved. We have a duty to be fair. We must make sure they are not forgotten. We must be fair to all people. We must provide all people the safety and medical help the rest of the population enjoys.

Economic

We must think about the economic parts of the problem. "Economic" is concerned with money, income, and use of wealth. Getting sick from mosquito borne diseases costs people large amounts of money. This is felt at the household, community, and industry level. It is important to show people how much can be gained economically by reducing the problem of mosquito-borne diseases. We must also convince people that there are more than just health benefits. A country may grow faster and improve the economic status of its people by reducing malaria. People can save money when they are no longer spending money getting care from doctors. They can save money by not missing days of work and school due to malaria illness.

Social

It is important to consider the social part of the problem. "Social" is concerned with the interaction of people in a community. People must work together to create and maintain protection from mosquito-borne diseases within the community. The community includes leaders, parents, and children. The community needs to understand the importance of fighting these diseases. The community is needed to successfully implement solutions at the local level. If the people in a community are not involved, you will not get very far with any solutions or changes.

Environmental

It is important to understand the environmental parts of the problem. "Environmental" is concerned with the natural world. It is also concerned with human impacts on the natural world. For example, any insecticide that is used to fight mosquitoes first must go through rigorous tests. The tests should determine potential environmental effects on all parts of the natural world. These tests should ensure the insecticides are safe to use. Plans must make sure that exposure of the environment to chemicals is reduced.

Why is it important to consider a problem from various perspectives (social, ethical, environmental, economic) when making decisions and developing solutions to problems?

You must make sure you can get participation from all parts of a community or country. Mosquito-borne diseases should not be seen just as a health issue. They are also an economic issue. You can engage with the finance and private sectors to get involved and increase your impact. In addition, you must work on environmental issues with the agricultural sectors of your community. This will ensure that everyone has the same goals. It will also help make progress on health, food, nutrition, and environmental protections.

Mosquito! Task 1-6 Defining the Problem

DAVID PECOR

RESEARCH TECHNICIAN

Organization:
The Walter Reed Biosystematics Unit (WRBU)

What is on David's identity map?

LOVE DOGS.
LOVE PUNK ROCK MUSIC.
BIG BROTHER.
FATHER.
WRITER.
BALD.
LOVE TO HIKE.
FRIENDLY.
COFFEE FANATIC.
FAVORITE PLACE:
GLACIER NATIONAL PARK, MONTANA.

Compare it with yours!

Why is the mosquito problem such an important issue for people to understand around the world?

There are almost no places you will not experience some impact from mosquitoes, besides Antarctica. In many places they are just annoying biters. In other places, they carry diseases. There is no escaping them. Although mosquitoes are found nearly everywhere, individual species distributions can change dramatically over time. Humans spread mosquitoes around the world via travel and trade. Climate change may also cause mosquitoes to move into new areas. Many places are currently free of mosquito-borne diseases. This does not mean they are completely safe in the future. If an infected person is exposed to the local mosquitoes, the diseases can be spread to people who are not aware of these diseases.

Provide a brief description of your work on mosquito-borne diseases.

I primarily work on the VectorMap project. This is an online source for mosquito collection data. It also includes information about the places mosquitoes like to live. It is designed to permanently store data associated with mosquito observations. This is similar to a museum that is tasked with permanently protecting samples. The goal is to determine the risk of mosquito-borne diseases in different places. It also helps us monitor how the problem may be changing over time. It is important to capture as much detailed observation data as possible.

How much is still not known about mosquitoes and mosquito-borne diseases in your field of work?

There are many things to discover in this field. There are more than 3,600 known types of mosquitoes. Many of these and more have not yet been described. The impact of many of these mosquitoes on humans is also unknown. Another thing we do not know is the number and nature of the diseases that have not been described. Diseases in nature could spill over into humans via mosquitoes. One of the biggest challenges in this work is providing access to the tools to combat mosquito-borne diseases, mainly for the people who need it most. Mosquito-borne diseases unfairly affect people living in the developing world. This is because many of these diseases are common to tropical and sub-tropical climates (Africa, South America, Southeast Asia). For this reason, access to tools, education, and training must be provided to people with the greatest risk.

Why is it important to look at the mosquito problem from different perspectives?

Ethical

We must think about the ethical parts of the mosquito problem. "Ethical" means the fairness of something. I believe countries with technology and education related to mosquitoes have an ethical duty. These people must share that knowledge with the developing world. This is because the disease problem is much greater for people living in developing countries. We must help them solve the biggest issues surrounding mosquito control.

Economic

We must think about the economic parts of the problem. "Economic" is concerned with money, income, and use of wealth. No other animal has affected human economics more than the mosquito. Mosquitoes have been responsible for countless lives lost over our history. Even now, mosquito control strategies are expensive (for example, pesticide development, spraying insecticides, digital mosquito monitoring tools, etc.).

Social

It is important to consider the social part of the problem. "Social" is concerned with the interaction of people in a community. Community participation is a big part of mosquito reduction. The community must understand that mosquitoes can use human products left outside. Therefore, making it socially unacceptable to leave out trash is one step in addressing the problem.

Environmental

It is important to understand the environmental parts of the problem. "Environmental" is concerned with the natural world. It is also concerned with human impacts on the natural world. Mosquitoes play many important roles in the places they live. Mosquitoes help many plants survive. They are also food for other animals, such as birds, bats, and fish. In many communities, mosquitoes are all considered bad. However, there is growing evidence that they have more value in nature than we typically give them credit for.

Why is it important to consider a problem from various perspectives (social, ethical, environmental, economic) when making decisions and developing solutions to problems?

Solutions that only address single or limited perspectives are unlikely to be successful. I believe an integrated approach to problem-solving is essential, especially when dealing with hard problems like mosquitoes and mosquito-borne disease. This problem is universal and affects everyone. We must consider multiple perspectives to ensure solutions help everyone involved.

Mosquito! Task 1-6 Defining the Problem

KELLY BENNETT

BIOLOGIST

Organization:
Smithsonian Tropical Research Institute (STRI)

What is on Kelly's identity map?

FEMALE.
SISTER.
WHITE BRITISH.
SPEAK SPANISH.
BROWN EYES.
YOGA.
LOVE READING AND ART.
LOVE TO HIKE AND TRAVEL.
QUIET.
LIVE IN A SMALL TOWN IN THE JUNGLE.
LOVE MUSIC.
LOVE TO SWIM.
BROWN CURLY HAIR.
SHORT.

Compare it with yours!

Why is the mosquito problem such an important issue for people to understand around the world?

The problem of mosquito-borne disease has been greatly affected by increased human movement and trade around the world. This human movement has allowing these mosquitoes to travel and establish new places to live. In addition, people are having increased contact with forests. As humans urbanize their surroundings, diseases can switch from using animals to using humans as a host. This worldwide network of invasion and increasing urbanization is a big part of the problem. It means we must work together as one to reduce the introduction of mosquitoes into new places. Mosquitoes tend to be highly adaptive. New diseases are also emerging and spreading rapidly. A recent example is Zika virus. This disease has been around for a long time. Yet only recently has it become a world-wide problem. This is likely due to the mosquitoes adapting to their surroundings. These mosquitoes are adapting to take better advantage of humans.

Provide a brief description of your work on mosquito-borne diseases.

I am currently working on two projects focusing on the Aedes mosquito in Panama. These mosquitoes can transmit dengue, chikungunya and Zika virus. The first goal of my work is to identify whether mosquito populations in Panama are adapting to their local environments. We also are trying to learn how these populations are connected. This is important to understand when thinking about mosquito control efforts in Panama. In the second project, I am investigating the natural strains of *Wolbachia* bacteria. Infection with this bacteria can affect disease transmission in mosquitoes. However, whether the bacteria effectively reduces transmission depends on the interaction of *Wolbachia* strains. Therefore, it is important to understand which strains are naturally present. This is helpful to determine whether such control methods would work in Panama.

How much is still not known about mosquitoes and mosquito-borne diseases in your field of work?

Relatively little is known about even basic life and behaviors. We must learn more about things that contribute to disease risk and how mosquitoes transmit diseases. We need to acquire information about many mosquito life history traits. These traits include mating behavior, egg-laying behavior, preferred habitats, seasonal differences in amount of mosquitoes, distribution, host preferences, development, and competition between and within species. All of these factors contribute to disease risk. The greatest challenge is to bring all the expertise together to understand how to control mosquito-borne diseases.

Why is it important to look at the mosquito problem from different perspectives?

Ethical

We must think about the ethical parts of the mosquito problem. "Ethical" means the fairness of something. There are many new and alternative mosquito control methods currently being researched. Many of these new methods raise ethical concerns. For example, releasing genetically modified mosquitoes into the wild. Should we do this? We must think about the ethical side of all decisions we make.

Economic

We must think about the economic parts of the problem. "Economic" is concerned with money, income, and use of wealth. Many countries suffer from a large economic burden due to mosquito-borne disease. This burden puts pressure on medical facilities and health workers. It also requires large amounts of money to support these facilities and sick people. Many of these places must also spend money on mosquito monitoring and control.

Social

It is important to consider the social part of the problem. "Social" is concerned with the interaction of people in a community. For example, people in many areas of the world do not have a piped water supply to their home. This means people without access to a reliable water source must store drinking water, providing habitats in which mosquitoes breed. Furthermore, poor housing and garbage disposal means lower income areas have greater exposure to biting mosquitoes. Many of these areas also do not have as much access to medical facilities. This can increase the number of fatalities from mosquito-borne diseases.

Environmental

It is important to understand the environmental parts of the problem. "Environmental" is concerned with the natural world. It is also concerned with human impacts on the natural world. Spraying insecticides is an environmental part of the problem. These methods can possibly contaminate water sources and kill other non-mosquito species. These environmental parts of the problem must be considered when making decisions.

Why is it important to consider a problem from various perspectives (social, ethical, environmental, economic) when making decisions and developing solutions to problems?

Without taking into account all perspectives, an approach is likely to fail. For example, imagine there is an effective way to control mosquitoes that requires the active participation of the local community. Without the community support, the method is unlikely to succeed. Similarly, if this hypothetical approach successfully reduces the mosquitoes but is too expensive to maintain, the approach will not be succcessful into the future.

Mosquito! Task 1-6 Defining the Problem

BRIDGET GILES

RESEARCH ASSISTANT PROFESSOR

Organization:
Virginia Modeling Analysis & Simulation Center at Old Dominion University (VMASC)

What is on Bridget's identity map?

FEMALE.
MOTHER.
AFRICAN AMERICAN.
WIFE.
LOVE TO READ.
LOVE MOVIES.
LOVE TO DANCE.
BELIEVES IN EQUALITY FOR EVERYONE.
LIKES GOSPEL AND R&B.
BELIEVES IN GOD.
BORN IN VIRGINIA.
LOVE SPENDING TIME WITH MY SONS.

Compare it with yours!

Why is the mosquito problem such an important issue for people to understand around the world?

Mosquitoes are the most dangerous animals in the world. They cause millions of deaths each year. Recent changes in the climate and longer warm-weather seasons are creating more problems. These warmer temperatures create more mosquito-friendly habitats around the world. This will potentially lead to more mosquito-borne diseases including Zika, malaria, dengue fever, yellow fever and West Nile virus.

Provide a brief description of your work on mosquito borne diseases.

I lead a team of researchers. Together we developed a video game to educate families about their ability to stop the mosquito-borne disease Zika. The video game is call ZAP. ZAP stands for Zika Awareness and Prevention. The 3D simulations provide interactive education exercises about individual-level protection practices. This includes how to remove mosquito breeding sites around your home, correct use of larvicide, placement of screens on windows and doors, and how to dress to defend yourself against mosquito bites. The video game also addresses symptoms of Zika virus infection. It gives special precaution recommendations for pregnant women. Videos are included in the game. In addition, Zika trivia and matching games are provided to test knowledge.

How much is still not known about mosquitoes and mosquito-borne diseases in your field of work?

One challenge people are currently working on is a safe and effective Zika vaccine. Although pregnant women are usually excluded from vaccine research, pregnant women are at the center of the Zika epidemic. So, bioethics groups have to consider the pros and cons of including pregnant women in Zika vaccine research.

Why is it important to look at the mosquito problem from different perspectives?

Ethical

We must think about the ethical parts of the mosquito problem. "Ethical" means the fairness of something. Individuals need to discuss sensitive topics related to sexual and reproductive health.

Economic

We must think about the economic parts of the problem. "Economic" is concerned with money, income, and use of wealth.Public officials need to invest in mosquito control measures like aerial spraying. But this is expensive and requires money.

Social

It is important to consider the social part of the problem. "Social" is concerned with the interaction of people in a community. One must implement personal protective measures, such as using insect repellent and condoms, if one is living in or traveling to an area with Zika.

Environmental

It is important to understand the environmental parts of the problem. "Environmental" is concerned with the natural world. It is also concerned with human impacts on the natural world. Individuals should regularly remove standing water around the home. Homes should also use water treatment tabs to kill larvae in standing water that cannot be removed.

Why is it important to consider a problem from various perspectives (social, ethical, environmental, economic) when making decisions and developing solutions to problems?

That is the only way to consider the whole picture of the problem. Considering the problem from various perspectives is the only way to come up with an effective solution.

Mosquito! Task 1-6 Defining the Problem

LEE COHNSTAEDT

RESEARCH ENTOMOLOGIST

Organization:
United States Department of Agriculture (USDA)

What is on Lees's identity map?

LOVE ANIMALS.
THESPIAN.
SPANISH SPEAKER.
RUNNER.
WRESTLER.
NERD.
COMMUNITY SERVICE.
BACKPACKER.
GERMAN SPEAKER.
TRAVELER.
LIKE STRATEGY GAMES.
HARD WORKER.
LOYAL.
INVENTOR.
LIKE CHESS.
TEAM PLAYER.
SCIENTIST.
LIKE TO HELP PEOPLE.

Compare it with yours!

Why is the mosquito problem such an important issue for people to understand around the world?

Mosquitoes are a nuisance at best and at worst the most dangerous animals in the world. Billions of people are at risk of mosquito-borne diseases every day. Globally, mosquitoes can change the landscape by influencing where animals and people live. Mosquitoes influence global production in most of the developing world. Furthermore, mosquito-borne diseases can always be introduced to a country where they were not before. This was the case with West Nile, Zika, and chikungunya viruses. Even if mosquitoes are not as abundant or a problem in the developed world, this does not mean they are not for the rest of the world or in the future.

Provide a brief description of your work on mosquito-borne diseases.

Two, four, six, eight: The USDA works to protect two-legged and four-legged animals from six- and eight-legged ones (insects and ticks). Specifically, I try to prevent outbreaks of diseases that will affect humans or animals in the United States. I do this by looking at various ways to monitor, control, or treat disease related insects such as mosquitoes or their associated diseases. The main focus of my work is zoonotic diseases, or animal diseases that may result in human illness.

How much is still not known about mosquitoes and mosquito borne diseases in your field of work?

The more we know, the more we realize we don't know. Research always advances understanding and creates more questions. Currently there is a large amount of research on sterile mosquitoes. Other research is on genetic changes that can make mosquitoes not blood feed. However, mosquito research can also be used to address big ecological questions such as global climate change. In 2001, mosquitoes were one of the first organisms to show genetic shifts in as short as five years. Similarly, genetic flexibility allows exotic mosquitoes to adapt rapidly to new environments. There is no limit to what we need to learn or what we can learn about mosquitoes.

Why is it important to look at the mosquito problem from different perspectives?

Ethical

We must think about the ethical parts of the mosquito problem. "Ethical" means the fairness of something. There are many ethical questions to consider about mosquitoes. Such as, should humans intentionally kill off a species of mosquito? Or how do we protect the more than 2 billion people making less than $2 a day who are at risk of mosquito-borne diseases?

Economic

We must think about the economic parts of the problem. "Economic" is concerned with money, income, and use of wealth. However, the brunt of mosquito-borne illness is suffered by the poorest individuals worldwide. Providing low-cost, easy-to-use materials and methods for mosquito control is an effective way to quickly help alleviate some of the disease burden. However, this is not a sustainable plan. Only by changing the economic status of people and providing them with permanent, stable housing with screens, running water, and other basic amenities can mosquito-transmitted diseases be reliably controlled.

Social

It is important to consider the social part of the problem. "Social" is concerned with the interaction of people in a community. Mosquitoes are not restricted by boarders or property lines. They will move and live where the blood is. Therefore, we must all work together to eliminate mosquitoes from our communities. If one of us fails, it is up to the others, to take up the work because the mosquitoes will live where they can and then the entire community will suffer.

Environmental

It is important to understand the environmental parts of the problem. "Environmental" is concerned with the natural world. It is also concerned with human impacts on the natural world. Mosquitoes are clearly an environmental problem. If the larval habitats are removed, the mosquitoes will be eliminated. However, removing the environmental problem means addressing the need for the water containers. Providing clean, reliable drinking water eliminates the need to store water in containers, where mosquitoes like to breed. Environmental change alone will not solve the problem, though. That change can only happen with simultaneous social and economic change.

Why is it important to consider a problem from various perspectives (social, ethical, environmental, economic) when making decisions and developing solutions to problems?

We are humans and many things influence our lives every day. These include work, life, community, the environment, family, and friends. If we make decisions based only on one of these perspectives, the solution will only address one of these areas. Our world is complicated and consists of many parts and perspectives. Without addressing all of the parts, the solution is not likely to work with the other parts. Simple questions tend to have simple answers. However, a simple single perspective answer will likely only address the symptoms of an issue and not the problem. It can then leave other people with different perspectives answerless. For example, we may ask people to empty water containers around their houses, which is a simple task. But it takes time and effort over the other many individual needs that must be done daily. Most people do not have or do not make the time to monitor their property even weekly for mosquito larval habitat. This is likely for many social, environmental, or economic reasons. For a solution to be universally acceptable, it must address most, if not all the problems and perspectives, not just the symptoms.

Video Links for Task 1-6

The Loathsome, Lethal Mosquito

Mosquito Problem Overview

Description:

Good overview of mosquitoes and the mosquito borne disease problem.

https://youtu.be/IkmjCmvfeFI

Mosquito Hunter - Frontline Video

Description:

Good video to present overview of mosquito problem and community involvement.

https://youtu.be/0n6VtSam9To

Zika Awareness and Prevention (ZAP) Game

The Zika Awareness and Prevention (ZAP) Game was developed to strengthen students and communities in their ability to stop Zika virus disease. Zika virus is a mosquito-borne virus, spread primarily by the bite of an infected *Aedes* species mosquito. Through simulation, this game educates students about Zika virus, common mosquito breeding sites, Zika virus disease symptoms, and pregnancy risks associated with Zika. Practices that help to prevent mosquito bites are also covered such as using an EPA registered insect repellent with DEET, the importance of wearing long sleeved shirts and long pants when outdoors, and treating clothing with permethrin. Multiple choice and matching games are provided to gauge how much you learned about Zika.

Use the following link to access the game, and have fun!
http://zika.vmasc.odu.edu/zap/

Computer WebGL Compatibility: Chrome 64 bit Version 57 and newer, Microsoft Edge version 16 or newer, Safari version 11 or newer, and Firefox version 52 or newer. Firefox users check your privacy settings.

For more information about the ZAP Game or for any other concerns please email us at Zapzika@odu.edu or contact:

Bridget Giles PhD
Virginia Modeling Analysis and Simulation Center
Old Dominion University
1030 University Blvd.
Suffolk, VA 23435
Email: bgiles@odu.edu
Phone: 757-638-4436

Team News Article Links for Task 1-6

Zika ZAP Game Bridget Giles News Article
https://www.odu.edu/news/2017/6/zika_game#.WzE7aadKiUk

Rusty Low Institute for Global Env. Strategies News Article
https://medium.com/usaid-2030/arming-citizen-scientists-with-an-app-to-identify-zika-carriers-f8af4ff7391d

Lee Cohnstaedt USDA News Article
http://www.fox5dc.com/news/local-news/md-students-taking-part-in-research-project-to-help-track-mosquitos-that-may-carry-zika

Kelly Bennett STRI News Article
https://newsdesk.si.edu/releases/smithsonian-scientists-track-aedes-mosquito-invasions

David Pecor WRBU News Article
https://insider.si.edu/2016/06/smithsonians-mosquito-collection-weapon-battle-zika/

1-7 Understanding Community Action Plan

As you learned in Task 1-6, the team will be focused on creating solutions to the problem question: How can we ensure health for all from mosquito-borne diseases?

There are many possible solutions to this question. This is why we must conduct research to learn more about the problem in our community. Then we can suggest decisions and actions we think people should take. At the end of your research, the team will need to create and communicate a community action plan. All of the team research will help you create the community action plan.

Objective

In this task, the team will learn more about the community action plan you will make in the future.

1. Go to the Task 1-7 folder to read the details of the community action plan.
2. There is only one version of the community action plan.
3. Read through the details of the action plan as a team. Ask questions about any parts that are not clear. Remember not to worry. Research is not easy. Sometimes things might not work out the way you planned. Learning how to work through the problem is part of the challenge and fun.
4. Read the Meet the Team Reading, with stories about when things did not work out during research projects and action plans. Think about how your team can work together when things do not work out as planned to reach your research and action plan goals.

Research Tip

Part Seven of the Community Research Guide is all about creating your community action plan. Remember that all of your research is leading to the creation of this plan.

Hooray! You completed Task 1-7. Check it off the task list. *Go to Task 1-8!*

Task 1-7 Understanding Community Action Plan

This document details the Community Action Plan that the team will create at the end of your research. The team will not be creating this plan now. However, understanding what you will be working toward completing at the end of your research is helpful even before you begin your research. Read through this plan, so the team understands everything they will need to complete by the end of your work. Then, as you are doing your research, think about how the information you are gathering could be useful for this final action plan and to address the problem question: How can we ensure health for all from mosquito-borne diseases?

The Community Action Plan will have three parts.

1. **Research area background, evidence collected, integrated management plan developed** (this part involves organizing what you will have already completed during your research)
2. **Action goals** (this part involves figuring out what you will do after you finish your research)
3. **Communication strategy** (this part involves telling people about your research, action goals, and plan)

Research Area Background

Provide a brief overview of your location and research site. This will help other people who are looking at your plan now and in the future. This section involves organizing what you did during your research. Include the following.

1. **Research location physical description:** Provide a brief description of your physical location. Include your position within your community, country, and the world.
2. **Team and local culture description:** Provide a brief description of your team and any local culture your team identified during your research. Include your team's identity map from Task 1-5 as part of this description.
3. **Map of research site:** Provide a map of your research site and any important information you collected concerning the site that would be useful to understand your plan. If possible, include pictures of your research site.
4. **Evidence and claims:** Organize and share all of the evidence you collected during your research and any claims you developed.
5. **Local integrated management plan:** An integrated management plan outlines all of the different management strategies you think your community should consider to address the problem question: How can we ensure health for all from mosquitoes? Tasks 6-1 and 6-3 will help you outline an integrated management plan for your community.

Action Goals

It is one thing to have an integrated management plan and another to set local goals to help people act on that plan. For example, part of your plan could be to empty the standing water from all containers in an area. Another part of the plan could be to educate various people in your community about the problem. Setting local action goals will help you determine what actions need to be taken now and in the future, who is responsible for taking them, and how the actions will be monitored to determine their effectiveness over time.

1. Develop a list of action goals that could be carried out by various people in your community to work toward different parts of your integrated management plan. Consider the following when creating your action goals: What type of action is needed and what is the action meant to address? Provide a description of the action. Some examples include:
   - Education action goals: Create and hand out brochures to educate the community about mosquitoes. This action will increase local knowledge and spark actions of community members concerning mosquitoes and mosquito management.
   - Advocacy action goals: Create posters to advocate for a group of people at risk from mosquitoes. Write letters to local officials and community leaders concerning mosquitoes and their effect on different groups of people in your community.
   - Physical action goals: Monitor your research site weekly for standing water where mosquitoes could breed. This action will reduce the number of possible breeding sites mosquitoes can use in the community. Document and remove any standing water found in the site every week throughout year.
   - Be creative and develop your own goals for your community!
2. Who is responsible for the action: self, team member, team, specific community member(s), all community members
3. Action schedule or timeline: When and how often does the action need to take place?
4. Action monitoring: How will the action goals be documented or monitored over time to determine their effectiveness? How will your team determine whether the action is working effectively? Create a strategy to monitor these goals over time.
5. Put the actions in order: If you have a list of action goals, which ones would you recommend be done first, second, and third? Create an order for all of your actions so the team knows where to start.

Communication Strategy

If no one outside of your research team knows about your plan, can it make an impact? Next, you will need to develop a plan to creatively communicate parts of your action plan to your community. Make sure you include the social, ethical, economic, and environmental parts of the problem. How will you educate others about your evidence, claims, decisions, and action goals?

Be creative! This plan can include:

- Making posters or art projects to communicate parts of your plan
- Writing a song or a one-act play to communicate parts of your plan
- Writing and recording a public service announcement (audio or video) to communicate parts of your plan
- Creating a social media campaign to communicate parts of your plan
- Be creative; come up with your own ideas!

After you have developed your communication strategy, you will need to share and present this information with your community. This can include parents, educators, administrators, local community members, and other team members.

Each group should include the following when communicating with community members.

- Present social, ethical, environmental and economic considerations for the community.
- Support all claims with evidence (data and statistics, expert opinion, personal and secondhand experience) within the plan.
- Support all suggested actions using claims and evidence.
- Clearly explain, demonstrate, and illustrate parts of your integrated management plan.
- Clearly explain, demonstrate, and show all aspects of your action goals.
- Clearly outline how the plan will be monitored for effectiveness over time. Discuss how the plan can be adjusted if it is not working or needs to be improved.

Go back to Research Guide now

Mosquito!: Task 1-7 Understanding Final Action Plan

Tell us about a time when a research project did not work out as planned?

David Pecor - Research Technician -Walter Reed Biosystematics Unit (WRBU)

Recently our team developed a big plan for a project to reduce malaria in three countries. We developed the project plan for over a year. We also spent many months working with new partners for three teams. After nearly a year of work, our project was rejected by the group providing the money. Although it is common for at least some projects to be rejected, we did not expect it. It was somewhat disappointing. However, that rejection taught me to except failure as part of any learning process. Instead of giving up, we went back to the drawing board with the failed project. We listed all of the issues we thought were behind the failure. Since that time, this project has seen new life as parts in several other new projects. We submitted these new projects and have been awarded funds to make them happen. This lesson taught me that rejection is not failure. It is only failure if you do not take the time to learn from it and work to improve. Think about how your team can work together when things do not work out as planned to reach your goals. It is important to be creative!

Meera Venkatesan - Malaria Technical Advisor - President's Malaria Initiative - United States Agency for International Development (USAID)

When I went to school, I wanted to work on a research project about mosquitoes and malaria. I also wanted to get experience working in different parts of the world. I picked my project with that expectation. Unfortunately, by the time I chose my research project, there were not opportunities to work on malaria mosquitoes in Africa, as I had planned. I was very disappointed. Luckily, I found a lab that was working on West Nile virus mosquitoes in the United States. This was a time when the disease was spreading across the country. I got to learn a lot of the same science working on West Nile virus. I also spent some time in Zambia using these new skills. Eventually I was able to transfer my knowledge and experience to malaria in Asia and Africa. I learned some important lessons along the way: 1) Getting a good background in any field is more important than the specific topic you work on; and 2) The exact opportunity you want may not always present itself. But with a little hard work, you can use it to get closer to your goals. Think about how your team can work together when things do not work out as planned to reach your goals.

Rusty Low - Senior Earth Scientist - Institute for Global Environmental Strategies

When I was a student, I had a research project looking at remains in the ground of an ancient cave. I was doing research about ancient flower grains on the floor of the cave. I had 60 samples to process. My goal was to develop a story about the past environment of the cave. What was there 10,000 years ago? Was it a forest? Was it a meadow? It was very time consuming work. I worked all summer. At the end of the summer, 58 of the 60 samples did not have anything in them. I was very disappointed. I thought I was going to have to quit the project. But my advisor Charlie said, "Great! Now you have an interesting research problem! Why did only those two samples have preserved plant fossils and the other 58 didn't?" He was right! Ever since, I think about this when I have a problem where things do not work out. I think about what my advisor Charlie said. It was a great life lesson when doing research projects. Think about how your team can work together when things do not work out as planned. Sometimes you just need to think about it from a different perspective!

Mosquito!: Task 1-7 Understanding Final Action Plan

Tell us about a time when a research project did not work out as planned?

Kelly Bennett - Biologist - Smithsonian Tropical Research Institute (STRI)

Experiments fail in the area of science frequently. However, perseverance and a positive attitude is the key to success. You can learn just as much from a failure as a success. In science, failures can lead you to a new path you may not have seen before. This is why you must stay positive when your research fails and try again.

Lee Cohnstaedt - Research Entomologist - United States Department of Agriculture (USDA)

We learn from our success, but we learn more from our failures. I make mistakes daily. That is why it is called research. If it worked the first time, it would just be called search. My lab motto is, "If you are going to be stupid, you have to be tough." Which means if we don't plan something out or if we mess something up, or if things do not go as planned (which always happens), we learn, adapt, and continue with the modifications, and try again. This is true for all aspects of life, and we cannot let mistakes stop us from accomplishing our goals. Lastly, we learn much more from our mistakes than from our successes. So make mistakes, take calculated risks, learn, keep going, and never suffer the same failure twice.

Bridget Giles - Research Assistant Professor - Virginia Modeling Analysis & Simulation Center at Old Dominion University

Recently I applied to several grants to make improvements to the ZAP game. These improvements would make the tool more accessible to many people via Web, tablet, and app. Although I have not been successful, I have decided to keep trying to get funded to make improvements to ZAP. However, I am very fortunate to have met team members at the Smithsonian Science Education Center, who sees the value of this work, and through this partnership ZAP can reach learners throughout the world.

Team News Article Links for Task 1-7

David Pecor WRBU News Article
https://insider.si.edu/2016/06/smithsonians-mosquito-collection-weapon-battle-zika/

Kelly Bennett STRI News Article
https://newsdesk.si.edu/releases/smithsonian-scientists-track-aedes-mosquito-invasions

Lee Cohnstaedt USDA News Article 1
http://www.fox5dc.com/news/local-news/md-students-taking-part-in-research-project-to-help-track-mosquitos-that-may-carry-zika

Rusty Low News Article -USAID
https://medium.com/usaid-2030/arming-citizen-scientists-with-an-app-to-identify-zika-carriers-f8af4ff7391d

Zika ZAP Game News Article
https://www.odu.edu/news/2017/6/zika_game#.WzE7aadKiUk

Zika Awareness and Prevention (ZAP) Game

The Zika Awareness and Prevention (ZAP) Game was developed to strengthen students and communities in their ability to stop Zika virus disease. Zika virus is a mosquito-borne virus, spread primarily by the bite of an infected *Aedes* species mosquito. Through simulation, this game educates students about Zika virus, common mosquito breeding sites, Zika virus disease symptoms, and pregnancy risks associated with Zika. Practices that help to prevent mosquito bites are also covered such as using an EPA registered insect repellent with DEET, the importance of wearing long sleeved shirts and long pants when outdoors, and treating clothing with permethrin. Multiple choice and matching games are provided to gauge how much you learned about Zika.

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Computer WebGL Compatibility: Chrome 64 bit Version 57 and newer, Microsoft Edge version 16 or newer, Safari version 11 or newer, and Firefox version 52 or newer. Firefox users check your privacy settings.

For more information about the ZAP Game or for any other concerns please email us at Zapzika@odu.edu or contact:

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1-8 Exploring Research Perspectives

As you learned in Task 1-6 and 1-7, the team will be presented with various perspectives of the problem throughout your research: social, ethical, environmental, and economic.

Objective

In this task, the team will explore these perspectives to understand them better.

This task only requires space for a continuous line (real or imagined) from one side of the room to the other.

1. Post one sign stating STRONGLY AGREE and one sign stating STRONGLY DISAGREE on opposite walls or corners of the room. The space between these two signs is the continuum. Put a sign in the middle of these two signs that states NOT SURE.
2. The team will hear a variety of statements.
3. After each statement, each team member should place themselves along the continuum based on how much they agree or disagree.
4. Go to the Task 1-8 folder to get the statements, further instructions, discussion questions and Meet the Team Reading. Choose the Mosquito A or Mosquito B version of this task.
5. Go over the team norms together in the task folder.
6. Follow the instructions to play the warm-up round.
7. As a team, discuss the Warm-Up Discussion Questions.
8. Follow the instructions to play four Perspectives rounds and questions.
9. As a team, discuss the Task 1-8 Discussion Questions.
10. Read the Meet the Team Reading on what to do when the team does not agree?. Learn about and discuss the ways their teams work through disagreements. Think about how your team can best work together to respect everyone's ideas.

Research Tip

Display a set of talking norms team members can use during discussions. These norms are helpful to have respectful conversations, especially when you don't agree.

Hooray! You completed Task 1-8. Check it off the task list. *Go to Task 1-9!*

Task 1-8 Exploring Research Perspectives—Mosquito A

Team Norms

- Recognize the benefits of listening to a range of different perspectives and viewpoints.
- Be open to new ideas and perspectives that challenge your own.
- Be willing to cooperate with others to change things for the better.
- Use active listening skills.
    - Face the person talking.
    - Look them in the eye.
    - Be attentive.
    - Keep an open mind.
    - Don't interrupt.
    - Ask questions if you are confused.

Warm-Up Round Instructions

1. Here is the warm-up round statement.

Bananas are the best-tasting fruit.

2. There are not necessarily any right or wrong answers, and everyone's view will fall somewhere along the continuum, from strongly agree to strongly disagree.

3. Take a minute and let each team member think about their position on that statement. Explain the next step, so team members can choose where to stand along the continuum.

- Explain that relative location is also important; that is, standing closer to the strongly agree or disagree side of the room means you feel very strongly about this statement.

4. Once each team member is located along the continuum, direct the team members to begin explaining to those standing near them why they placed themselves as they did. Students should explain their reasoning for their location.

5. Based on these discussions with the people near them, they should be "recalibrating" with each other. This is the process of listening to other team members near them and determining whether they really are more or less extreme in their thoughts and feelings on the topic. Encourage team members to move as necessary to accurately represent the continuum of opinion on the team.

Warm-Up Round Discussion Questions

- Can individual team members explain to the team the reasons for their position on the continuum?
- How many team members changed their positions after talking to other team members around them on the continuum?
- How many team members changed their positions after hearing people talk during the whole team discussion?
- What led you to change your mind?

- Conclude the discussion by asking team members on both sides of the issue to identify what they believe to be the strongest arguments and reasons they heard from the *opposing* side.

Four Perspectives Rounds Instructions and Questions

1. The line continuum setup for the next four rounds stays the same. The main difference is the team is now divided into groups of three to four team members.
2. Each group will negotiate their position along the continuum, based on the following statement.

Ethical perspective: It is okay to kill all of the mosquitoes on the planet.

3. Each group must determine where they are located on the continuum as a group.
4. Each group will send one representative to identify the place on the continuum line that best represents the group's view.
5. Now the representatives from each group will explain to the whole team the reasons for their group's position on the continuum. Members of the group speaking can support the representative at any time.
6. After each group has had a chance to share, each group should have a brief discussion about whether they would like to move their location on the continuum, based on the team discussion.

- How many groups changed their positions after hearing people talk during the whole team discussion?
- What led you to change your mind or not change your mind?
- Conclude the discussion by asking team members on both sides of the issue to identify what they believe to be the strongest arguments and reasons they heard from the *opposing* side.

7. Repeat steps two through six for *one* statement from each of the following three perspectives categories.

Social Perspective

1. **People who live in places with mosquito-borne diseases should not be able to travel to other places to visit family.**
2. **People who get mosquito-borne diseases engage in some type of risky behavior.**

Environmental Perspective

1. **All mosquitoes are dangerous to humans.**
2. **Spraying potentially harmful chemicals to control mosquitoes around children and pregnant women is okay.**

Economic Perspective

1. **Mosquito bed nets protect you from mosquito bites when you are sleeping. It is okay that people who cannot afford to buy a bed net get sick more often from mosquito-borne diseases.**
2. **Every person should be required by the government to pay some tax money to help people who cannot afford to protect themselves from mosquito-borne diseases.**

Task 1-8 Discussion Questions

As an entire team, discuss the following questions.

Remind the team that you will now engage in a discussion. When engaging in any type of meaningful discussion as a team, you must respect your team. Use the meaningful conversation starters in your discussion to respect your other team members.

Meaningful conversation starters used in the language of argumentation:

- I agree with _____ because …
- I disagree with _____because …
- I'd like to go back to what _____ said about …
- I'd like to add _____
- I noticed that …
- Another example is …
- So, what you are saying is …
- Do you think that …?
- Couldn't it also be that …?
- Why do you think that?
- Can you explain what you mean?
- Can you tell me more?
- Can you give me an example of that?

1. How did your group arrive at your decisions?
2. What decision-making methods did your group use (consensus, voting, etc.)?
3. How were your decisions influenced by the values? Attitudes? Prejudices? Aspects of identity of people in your group?
4. How were disagreements and conflicts handled?
5. What are some benefits to listening to a range of different perspectives and viewpoints on the team?
6. Is it helpful to be open to new ideas and perspectives that challenge your own? Why or why not?

7. Is there anything you learned in this task that would be useful when thinking about the problem question: How can we ensure health for all from mosquito-borne diseases?

Go back to Research Guide now

Task 1-8 Exploring Research Perspectives—Mosquito B

Team Norms

- Recognize the benefits of listening to a range of different perspectives and viewpoints.
- Be open to new ideas and perspectives that challenge your own.
- Be willing to cooperate with others to change things for the better.
- Use active listening skills.
    - Face the person talking.
    - Look them in the eye.
    - Be attentive.
    - Keep an open mind.
    - Don't interrupt.
    - Ask questions if you are confused.

Warm-Up Round Instructions

1. Here is the warm-up round statement.

Bananas are the best-tasting fruit.

2. There are not necessarily any right or wrong answers, and everyone's view will fall somewhere along the continuum, from strongly agree to strongly disagree.

3. Take a minute and let each team member think about their position on that statement. Explain the next step so team members can choose where to stand along the continuum.

- Explain that relative location is also important; that is, standing closer to the strongly agree or disagree side of the room means you feel very strongly about this statement.

4. Once each team member is located along the continuum, direct the team members to begin explaining to those standing near them why they placed themselves as they did. Students should explain their reasoning for their location.

5. Based on these discussions with the people near them, they should be "recalibrating" with each other. This is the process of listening to other team members near them and determining whether they really are more or less extreme in their thoughts and feelings on the topic. Encourage team members to move as necessary to accurately represent the continuum of opinion on the team.

Warm-Up Round Discussion Questions

- Can individual team members explain to the team the reasons for their position on the continuum.
- How many team members changed their positions after talking to other team members around them on the continuum?
- How many team members changed their positions after hearing people talk during the whole team discussion?
- What led you to change your mind?

- Conclude the discussion by asking team members on both sides of the issue to identify what they believe to be the strongest arguments and reasons they heard from the *opposing* side.

Four Perspectives Rounds Instructions and Questions

1. The line continuum setup of the next four rounds stays basically the same—but with some differences that are described in the step three.
2. Present the following statement to the entire team.

Ethical perspective: It is okay to kill all of the mosquitoes on the planet.

3. Have each person individually place themselves along the continuum.
4. Next, create groups of three to four team members with the team members that are nearest you on the continuum.
5. Have each group work together to develop an explanation of the reasons for their group's position on the continuum. Share these explanations with the entire team.
6. After each group has had a chance to share, each group should have a brief discussion about whether they would like to move their location on the continuum, based on the team discussion.
   - How many groups changed their positions after hearing people talk during the whole team discussion?
   - What led you to change your mind or not change your mind?
   - Conclude the discussion by asking team members on both sides of the issue to identify what they believe to be the strongest arguments and reasons they heard from the *opposing* side.

7. Repeat steps two through six for *one* statement from each of the following three perspectives categories.

Social perspective

1. **People who live in places with mosquito-borne diseases should not be able to travel to other places to visit family.**
2. **People who get mosquito-borne diseases engage in some type of risky behavior.**

Environmental Perspective

1. **All mosquitoes are dangerous to humans.**
2. **Spraying potentially harmful chemicals to control mosquitoes around children and pregnant women is okay.**

Economic Perspective

1. **Mosquito bed nets protect you from mosquitoes when you are sleeping. It is okay that people who cannot afford to buy a bed net get sick more often from mosquito-borne diseases.**
2. **Every person should be required by the government to pay some tax money to help people who cannot afford to protect themselves from mosquito-borne diseases.**

Task 1-8 Discussion Questions

As an entire team, discuss the following questions.

Remind the team that you will now engage in a discussion. When engaging in any type of meaningful discussion as a team, you must respect your team. Use the meaningful conversation starters in your discussion to respect your other team members.

Meaningful conversation starters used in the language of argumentation:

a. I agree with _____ because …
b. I disagree with _____because …
c. I'd like to go back to what _____ said about …
d. I'd like to add _____
e. I noticed that …
f. Another example is …
g. So, what you are saying is …
h. Do you think that …?
i. Couldn't it also be that …?
j. Why do you think that?
k. Can you explain what you mean?
l. Can you tell me more?
m. Can you give me an example of that?

1. How did your group arrive at your decisions?
2. What decision-making methods did your group use (consensus, voting, etc.)?
3. How were your decisions influenced by the values? Attitudes? Prejudices? Aspects of identity of people in your group?
4. How were disagreements and conflicts handled?
5. What are some benefits to listening to a range of different perspectives and viewpoints on the team?
6. Is it helpful to be open to new ideas and perspectives that challenge your own? Why or why not?

Is there anything you learned in this task that would be useful when thinking about the problem question: How can we ensure health for all from mosquito-borne diseases?

Go back to Research Guide now

Mosquito!: Task 1-8 Exploring Research Perspectives

What do you do when the team does not agree?

David Pecor - Walter Reed Biosystematics Unit (WRBU)

Sometimes people on our team do not agree. When the team does not agree, we make sure to treat each other with respect. It is important to not bring your personal feelings or opinions into the argument. Just as in science, the best evidence will determine which path to take. Sometimes there is not enough evidence to decide the argument. This means the solution is to gather more information. The team will gather information until enough exists to support one side or the other. Sometimes the solution is to discuss issues or generate new ideas. Brainstorming sessions are needed for our team. We start by focusing the group around a single issue. Then we freely explore all possible (and even some impossible) solutions together via discussion. We begin to build ideas that will eventually become real solutions. Think about how your team can work together to respect everyone's ideas.

Meera Venkatesan - President's Malaria Initiative - United States Agency for International Development (USAID)

Sometimes people on our team do not agree. When this happens I try to understand where the other side is coming from. I try to put myself in their shoes. Even if we do not agree, I can at least see the discussion from their perspective. This helps me approach the discussion with humility and openness. It also helps the team come to a decision we all can support. Think about how your team can work together to respect everyone's ideas.

Russane Low - Institute for Global Environmental Strategies

Sometimes people on our team do not agree. However, it is important to see the value of listening to each member of the team. Listening deeply is not easy. It is actually very hard work. I try and see an issue from each person's point of view. Sometimes I do not completely know where they are coming from. In these cases I try and imagine what their story might be. It is a useful way to help me talk with people I do not agree with. Being a good leader means being a good listener. Think about how your team can work together to respect everyone's ideas.

Mosquito!: Task 1-8 Exploring Research Perspectives

What do you do when the team does not agree?

Kelly Bennett - Biologist - Smithsonian Tropical Research Institute (STRI)

Sometimes people on our team do not agree. This is an important part of science. Conferences, meetings, and networking events are invaluable to present our work to the scientific community. Public outreach events are also important to raise awareness of our findings to the nonscientific community. These events provide opportunities to engage the thoughts and concerns of all people involved.

Lee Cohnstaedt - Research Entomologist - United States Department of Agriculture (USDA)

Sometimes people on our team do not agree. Respect and empathy for others, perspectives are essential to effectively defending and presenting one's arguments. This is especially helpful when people do not agree. Bruce Lee, the famed martial artist, had a philosophy for his martial art (Jeet Kune Do), which was understanding other martial arts and incorporating their key pieces to make your own style. Another way to say this is: Understand what others are trying to do so you can defend yourself, and learn from them so you can use their moves, if it fits your style. When this philosophy is applied to life, it becomes: Learn about others, their motivations, drive, and perspective. Then, when you debate or communicate with them, be able to use the best tools - theirs, yours, or others, - to maximum effectiveness. Be true to oneself, but keep learning about others, so as to continue growth and development while maintaining an understanding of others and oneself.

Bridget Giles - Research Assistant Professor - Virginia Modeling Analysis & Simulation Center at Old Dominion University

Sometimes people on our team do not agree. Here at the Virginia Modeling Analysis and Simulation Center we build models, simulations, and visualizations to understand problems and make decisions. We investigate complex problems, design experiments, analyze data, and interpret results to help people begin to agree when at first they might not.

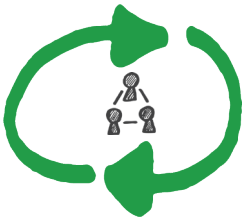
2-3 Surveying Community

In Task 2-2, you learned more about what the team thinks about mosquitoes. Now it is time to survey other people in your community to see what they know. This will help the team understand what people think about these various parts of the mosquito problem. This survey will also provide evidence that will be useful to understand what things people might not understand about mosquitoes.

Objective

In this task, the team will be focusing on the following questions from the question map in Task 1-10: What do people in our local community think and know about mosquitoes and mosquito-borne diseases? How can we effectively share and communicate mosquito-borne disease evidence with the community?

Go to the Task 2-3 folder and get the Survey and Meet the Team reading. Use the same version (A or B) of the survey the team used for the team survey in Task 1-3.



1. Read the Meet the Team reading on Mosquito Misconceptions. These are things people around the world commonly do not understand about mosquitoes.

- Watch the Mosquito Hunter video in the Task 2-3 folder on the Smithsonian Learning Lab.

2. Determine who the team will survey in the community. The survey will help you understand any misconceptions in your community.

   a. If you're surveying your family, friends, or people at school, decide who you will survey and why.

Research Tip

Use the field safety tips in the safety documents on Learning Lab before going out into the community to survey or interview people. Be polite, never go alone, and always be aware of your surroundings.

2-3

b. You can survey more than one person if you want.

c. If you're surveying someone in your community, decide who this person is and set up a way to conduct or provide them with the survey.

d. Whenever you're surveying people in your community, get permission from your team leader before contacting these people. Read through the safety documents concerning surveying or interviewing people in the Task 2-3 folder.

3. Determine how team members would like to conduct the survey.

   a. Oral interview: You ask the questions and document the responses.

   b. Provide each person a paper version of the survey and have them complete the survey on their own.

   c. If you have access to digital survey tools, figure out how you could use them. Tools such as SurveyMonkey and Google Forms/ Docs can be used, if available.

   d. If you have another strategy that works best for your team, do that!

4. Before you start surveying people, complete the following based on your team claims from Task 2-2.

   Write a hypothesis about which form of communication you think will be most available to your community.

   Example: Television is the most useful way to communicate to the community.

5. Conduct the survey and bring the results back to the next team meeting. In Task 2-4, the team will compile and analyze the results of parts one and two of these surveys.

Hooray! You completed Task 2-3. Check it off the task list. *Go to Task 2-4!*

Task 2-3 Surveying Community—Mosquito A

If technology is available, watch the videos in the Learning Lab Task folder to understand why it is important to learn about what your local community knows about mosquitoes, and how you can educate your community to help ensure health for all.

The survey starts on the next page.

Task 2-3: Community Mosquito—Survey A

Name:_____

Part 1: Background Information

Age:				
0-10	11-20	21-40	41-64	65+

Gender					
Male	Female	Non-binary/third gender	Prefer to self-describe: _____	Prefer not to say	

What town do you live in?

Is your home in the city, village, or rural?			
City	Village	Rural	Other

Availability of communication media in the house (check all that apply)			
Television	Newspaper	Radio	Computer
Tablet	Internet	Telephone	Mobile phone
SMS	Social media	Mobile phone with Internet	Other

Part 2: Community

How well do you understand mosquitoes?				
1. Not at all	2. Hardly	3. Somewhat	4. Well	5. Very well

How concerned are you about mosquitoes in your community?				
1. Not at all	2. Hardly	3. Somewhat	4. Concerned	5. Very concerned

Part 3: Life

Are both male and female mosquitoes able to transmit diseases to humans?			
Only male mosquitoes are able to transmit diseases to humans	Only female mosquitoes are able to transmit diseases to humans	Both male and female mosquitoes can transmit diseases to humans	Not sure

What time of the day do mosquitoes bite? (check all that apply)			
Day time	Night time	Morning	Not sure

Part 4: Transmission

Can mosquito-borne diseases be transmitted simply by being near people who are sick?		
Yes, mosquito-borne diseases can be transmitted by being near people who are sick	No, mosquito-borne diseases are not transmitted simply by being near people who are sick	Not sure

Can some mosquito-borne diseases be transmitted to other animals (birds, horses, dogs)?		
Yes, some mosquito-borne diseases can be transmitted to other animals	No, mosquito-borne diseases cannot be transmitted to animals	Not sure

Part 5: Habitats

Where do mosquitoes breed? (check all that apply)				
Still, stagnant water	Moving water	Drain	Water storage container	Garbage
Trash container	Old tire	Old car	Old boat	Holes in tree
Animal shell	Other	Not sure		

Do you have any containers holding water, or low areas with standing water around your home?		
Yes	No	Not sure

Part 6: Management

Where do you receive information on mosquitoes in the community? (check all that apply)				
Personal experience/observation	Family/friends	School/university	Television	Radio
Print/newspaper	Social media	Internet	Mobile phone	Doctors/health workers
Government	Other	Not sure		

Do you currently take any action to prevent yourself from getting a mosquito-borne disease?		
Yes	No	Not sure
If yes, please describe your action.		

Go back to Research Guide now

Task 2-3 Surveying Community—Mosquito B

If technology is available, watch the videos in the Learning Lab Task folder to understand why it is important to learn about what your local community knows about mosquitoes and how you can educate your community to help ensure health for all.

The survey starts on the next page.

Task 2-3: Community Mosquito Survey—Mosquito B

Name:_____

Part 1: Background Information

Age:				
0-10	11-20	21-40	41-64	65+

Gender					
Male	Female	Non-binary/third gender	Prefer to self-describe: _____	Prefer not to say	

What town do you live in?

Is your home in the city, village, or rural?			
City	Village	Rural	Other

Availability of communication media in the house (check all that apply)			
Television	Newspaper	Radio	Computer
Tablet	Internet	Telephone	Mobile phone
SMS	Social media	Mobile phone with Internet	Other

Part 2: Community

Is this the first time someone has surveyed you about mosquitoes?		
Yes	No	Not sure

How well do you understand mosquitoes?				
1. Not at all	2. Hardly	3. Somewhat	4. Well	5. Very well

How concerned are you about mosquitoes in your community?				
1. Not at all	2. Hardly	3. Somewhat	4. Concerned	5. Very concerned

During the worst times of the year, how severe are the mosquitoes around your home?				
1. Not severe	2. Minimal	3. Average	4. Fairly severe	5. Extremely severe

During the worst times of the year, how many times do you get bitten by mosquitoes in a day?						
0 bites	1-5 bites	5-10 bites	10-20 bites	20-40 bites	40+ bites	

What impact do mosquitoes have on your quality of life?			
Health Risk	Nuisance	No Impact	Other

Part 3: Life

Are there different types of mosquitoes, or are they all the same?		
There are different types of mosquitoes	They are all the same	Not sure

Are both male and female mosquitoes able to transmit diseases to humans?			
Only male mosquitoes are able to transmit diseases to humans	Only female mosquitoes are able to transmit diseases to humans	Both male and female mosquitoes can transmit diseases to humans	Not sure

What time of the day do mosquitoes bite? (check all that apply)			
Day time	Night time	Morning	Not sure

Where do mosquitoes get their food from? (check all that apply)		
Flowers	Sap from plants	Garbage
Blood from animals	Other	Not sure

Do mosquitoes lay eggs or give birth to developed mosquitoes?		
Lay eggs	Developed mosquitoes	Not sure

Part 4: Transmission

Can mosquito-borne diseases be transmitted simply by being near people who are sick?		
Yes, mosquito-borne diseases can be transmitted by being near people who are sick	No, mosquito-borne diseases are not transmitted simply by being near people who are sick	Not sure

Can some mosquito-borne diseases be transmitted to other animals (birds, horses, dogs)?		
Yes, some mosquito-borne diseases can be transmitted to other animals	No, mosquito-borne diseases cannot be transmitted to animals	Not sure

Part 5: Habitats

Where do mosquitoes breed? Check all that apply				
Still stagnant water	Moving water	Drain	Water storage container	Garbage
Trash container	Old tire	Old car	Old boat	Holes in tree
Animal shell	Other	Not sure		

Do you have any containers holding water, or low areas with standing water around your home?		
Yes	No	Not sure

Part 6: Management

Where do you receive information on mosquitoes in the community? (check all that apply)				
Personal experience/observation	Family/friends	School/university	Television	Radio
Print/newspaper	Social media	Internet	Mobile phone	Doctors/health workers
Government	Other	Not sure		

Which source do you most trust for accurate information about mosquito-borne diseases?				
Personal experience/observation	Family/friends	School/university	Television	Radio
Print/newspaper	Social media	Internet	Mobile phone	Doctors/health workers
Government	Other	Not sure		

Are you aware of the mosquito control services in the community?		
Yes	No	Not sure
If yes, please describe which services.		

Do you currently take any action to prevent yourself from getting a mosquito-borne disease?		
Yes	No	Not sure
If yes, please describe your action.		

How concerned are you about mosquito-borne diseases in your community in the future?				
1. Not concerned	2. Hardly concerned	3. Somewhat concerned	4. Concerned	5. Very concerned

Go back to Research Guide now

Task 2-3 Surveying Community

What things do people commonly not understand about mosquitoes?

David Pecor - Research Technician - Walter Reed Biosystematics Unit (WRBU)

I have encountered one misconception constantly. This misconception is about how many different types of mosquitoes there are in the world. Some people think of the "mosquito" as a single type of insect. They think all mosquitos are the same throughout the world. In fact, there are thousands of different species of mosquitoes. Less than 10 percent of them play a role in the spread of disease. People must understand that there are different types of mosquitoes. Each type has different behaviors. The behaviors will directly affect how effective control measures will be. Most types of mosquitoes are not harmful to humans. They actually play essential roles in the environment as pollinators and food for other organisms. Even within the small number of mosquitoes that spread disease, behaviors vary widely (what and when they like to eat, where they rest and reproduce). It is important that all people in a community understand these behaviors so they can design effective control strategies. What do people in your community think about mosquitoes? Ask them.

Meera Venkatesan - Malaria Technical Advisor - President's Malaria Initiative - United States Agency for International Development (USAID)

Many people in countries with mosquito-borne diseases know about the mosquitoes that carry the disease. They also know how to protect themselves. However, there are still misconceptions about when to use a net. Sometimes people will only use the net during the rainy season. People do not know that malaria can be transmitted all year round. The goal is to get net use to be regular, day in and day out. This is so people receive maximum protection from mosquitoes. It is important that all people in a community understand these things about the mosquito problem. What do people in your community think about mosquitoes? Ask them.

Rusty Low - Senior Earth Scientist - Institute for Global Environmental Strategies

Many people have misunderstandings about mosquitoes. For example, most people do not realize adult mosquitoes feed on plants and nectar. Only the female mosquitoes of some species bites people. Some mosquitoes do not bite at all! For example, Toxorhynchites are day-flying mosquitoes that do not need a blood meal to produce eggs, so they do not bite. As larvae these mosquitoes eat the larvae of its own kind and also other possibly dangerous mosquitoes. They eat so much that when they mature, they are ready to lay eggs without a blood meal! So these are good mosquitoes! (Ever hear of a good mosquito?) These are important mosquitoes in our ecosystems. They naturally reduce the number of other problem mosquitoes, like those that can spread diseases if allowed to mature into adults. Many people also do not know that mosquito larvae do not transmit disease. Diseases are transmitted through bites from a female preparing to lay eggs. It is important that all people in a community understand these things about the mosquito problem. What do people in your community think about mosquitoes? Ask them.

What things do people commonly not understand about mosquitoes?

Kelly Bennett - Biologist - Smithsonian Tropical Research Institute (STRI)

One misconception I encounter is that mosquito infestation can be successfully counteracted just with insecticides. This understanding causes many countries to rely only on this method to control mosquito-borne disease at great expense. However, due to the increase in insecticide resistance in mosquito populations worldwide, the application of chemical control is largely ineffective and can also have adverse environmental impacts.

Lee Cohnstaedt - Research Entomologist - United States Department of Agriculture (USDA)

If we do not understand a problem, we cannot hope to solve it. Therefore, people cannot protect themselves or their pets if they fear mosquitoes or worse, the tools used to reduce mosquito populations. For example, many people fear using DEET and other repellents because they are chemicals. However, being bitten by an infected mosquito and contracting malaria or dengue is much worse than the minimal risk of protecting oneself. Individuals should always try to be educated about what works, how it works, and how to use it. Then they can balance the risks between personal protection and exposure to chemicals.

Bridget Giles - Research Assistant Professor - Virginia Modeling Analysis & Simulation Center at Old Dominion University

Many people have misunderstandings concerning mosquito-borne diseases that affect their behaviors. Some people believe, “Oh, it will never happen to me” when it comes to getting bitten by a mosquito with a harmful virus like Zika. Therefore they do not take protective measures, like putting on insect repellent or wearing long pants and long-sleeve shirts. One challenge people are currently working on is a safe and effective Zika vaccine. Although pregnant women are usually excluded from vaccine research, pregnant women are at the center of the Zika epidemic, so bioethics groups have to really weigh the pros and cons of including pregnant women in Zika vaccine research. It will then be very important for this information to be understood by the public to move forward appropriately.

Team News Article Links for Task 2-3

Mosquito Hunter - Frontline Video
Description:
Good video to present overview of mosquito problem and community involvement.
https://youtu.be/0n6VtSam9To

2-4 Analyzing Community Surveys

In Task 2-2, the team learned how to analyze the team survey results for parts one and two. In task 2-3, you then surveyed people in your local community. In this task, you will do the same kind of analysis you did during Task 2-3. Now you will focus on the community survey results only for parts one and two, Background and Community, of the survey. The team will use this analysis to think about the social perspecitve of the problem. The team will analyze the other parts of the survey in future tasks. So keep the survey results in a safe place.

Objective

In this task, the team will be focusing on the following questions from the question map in Task 1-10: What do people in our local community think and know about mosquitoes and mosquito-borne diseases? How can we effectively share and communicate mosquito-borne disease evidence with the community?

1. Go to the Task 2-4 folder and get the survey analysis instructions and questions.
   - Choose Mosquito A or Mosquito B task from the task folder.
2. As a team, determine how to compile the community survey results for parts one and two for all team members. You will want to analyze the compiled data from the entire team. Develop your own method for compiling the data for parts one and two, or use one of the methods in the instructions.
3. Create some graphs about this compiled community survey data. Use the instructions and examples in the task folder.
4. Use your graphs and data to answer these questions:

- What interesting patterns do you see in the data from part one or two questions of the survey.

Research Tip

As you may have noticed, the survey is broken into the same parts as this research guide. Analyze only the results from that part of the survey while working on that Part of the guide to make the analysis more manageable.

2-4

- Which questions did most people in the community agree on?
- Which questions did people in the community have different responses for?
- Discuss how this survey evidence could be useful when thinking about the question: What do people in our local community think about mosquitoes and mosquito-borne diseases?
- Discuss how this survey evidence could be useful when thinking about the question: How can we effectively share and communicate mosquito-borne disease evidence with the community?
- Discuss how this survey evidence could be useful when thinking about the problem question: How can we ensure health for all from mosquito-borne diseases?

5. In Task 2-3, you wrote a hypothesis about which form of communication would be most available to the community.

- Example: Television is the most useful way to communicate to the community.

6. Using your team and community survey results, analyze the data from the question about availability of communication media to determine whether or not your hypothesis was supported by the evidence.
7. As a team, discuss different hypotheses and the evidence that supported it or not.
8. Select two or three survey questions, write a claim, and provide the supporting evidence for the claim based on the surveys you collected.
9. Examples:

- People in our community are not concerned at all about mosquitoes and mosquito-borne diseases.
- Social media is a useful way to communicate to our community.

10. Explain how the data evidence from the community survey supports your claims.
11. As a team, share some claims you created and the evidence that supports them.

Hooray! You completed Task 2-4. Check it off the task list. *Go to Task 2-5!*

Task 2-4 Analyzing Community Surveys—Mosquito A

Compiling Survey Data Options

First we must compile the answers from the community surveys to all of the questions from Parts One and Two: Background Information and Community. The team will look at the other parts in later tasks.

Here are some options for compiling the answers to the survey questions. But, as always, if you have different method you prefer, do that!

Option 1

Hand out a survey to each person.

Go through each question and team members can raise their hands to vote for the answer they prefer. Some team members can count up the votes and others can write down the totals for the team.

Option 2

Have questions on a board, paper, or computer where tallies can be compiled. Tally the responses and share the results.

Option 3

Digital survey: If you did the survey digitally, you should be able to see the results for each question.

Option 4

Create your own way of compiling survey data.

Graphing Survey Data

How could you graph parts of these survey results?

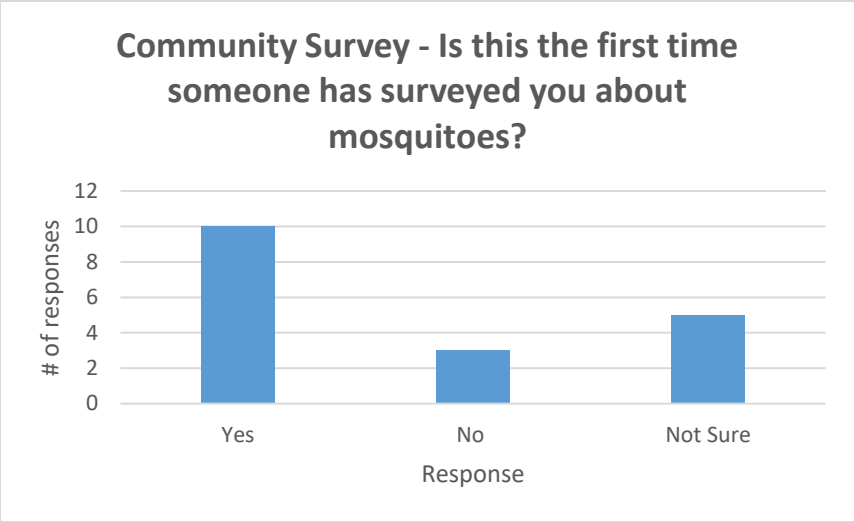
Which questions could you graph?

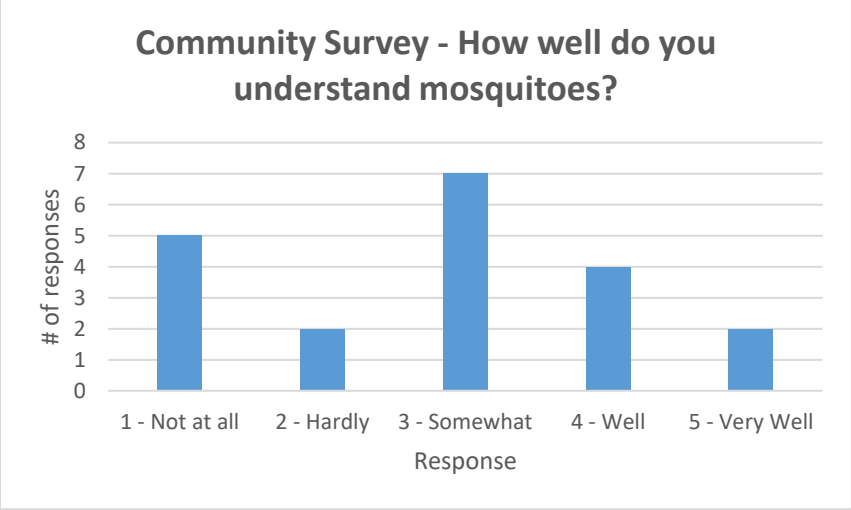
View the Task 2-4 graph examples.

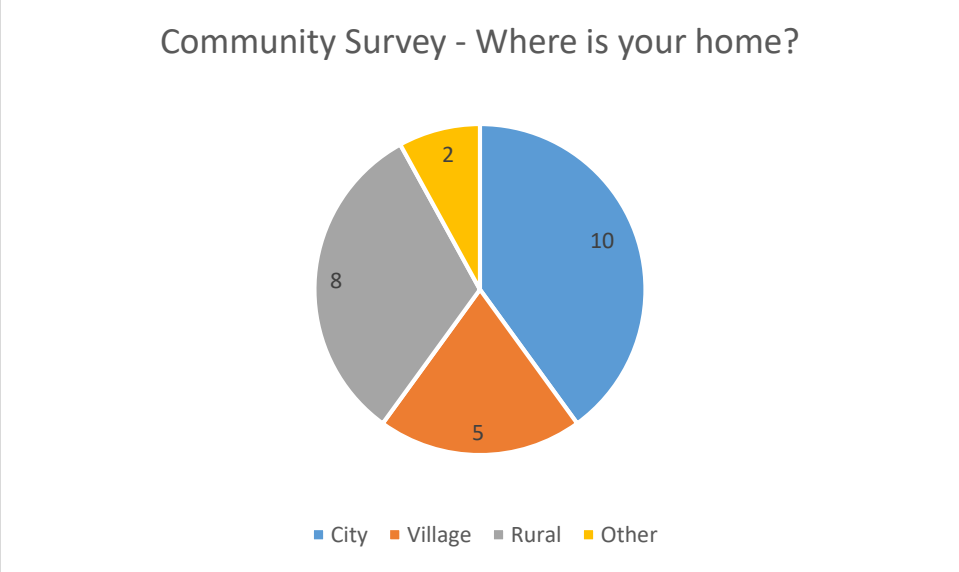
If you have the resources, pick some questions to graph that you think would be useful.

How would these graphs be useful when supporting claims with evidence?

Community Survey Graph Examples







Community Survey–Mosquito A

Use this survey to compile data.

Part 1: Background Information

Age				
0-10	11-20	21-40	41-64	65+

Gender					
Male	Female	Non-binary/third gender	Prefer to self-describe: _____	Prefer not to say	

What town do you live in?

Is your home in the city, village, or rural?			
City	Village	Rural	Other

Availability of communication media in the house (check all that apply)			
Television	Newspaper	Radio	Computer
Tablet	Internet	Telephone	Mobile phone
SMS	Social media	Mobile phone with Internet	Other

Part 2: Community

How well do you understand mosquitoes?				
1. Not at all	2. Hardly	3. Somewhat	4. Well	5. Very well

How concerned are you about mosquitoes in your community?				
1. Not at all	2. Hardly	3. Somewhat	4. Concerned	5. Very concerned

Go back to Research Guide now

Task 2-4 Analyzing Community Surveys—Mosquito B

Compiling Survey Data Options

First we must compile the answers from the community surveys to all of the questions from Parts One and Two: Background Information and Community. The team will look at the other parts in later tasks.

Here are some options for compiling the answers to the survey questions. But, as always, if you have different method you prefer, do that!

Option 1

Hand out a survey to each person.

Go through each question and team members can raise their hands to vote for the answer they prefer. Some team members can count up the votes and others can write down the totals for the team.

Option 2

Have questions on a board, paper, or computer where tallies can be compiled. Tally the responses and share the results.

Option 3

Digital survey: If you did the survey digitally, you should be able to see the results for each question.

Option 4

Create your own way of compiling survey data.

Graphing Survey Data

How could you graph parts of these survey results?

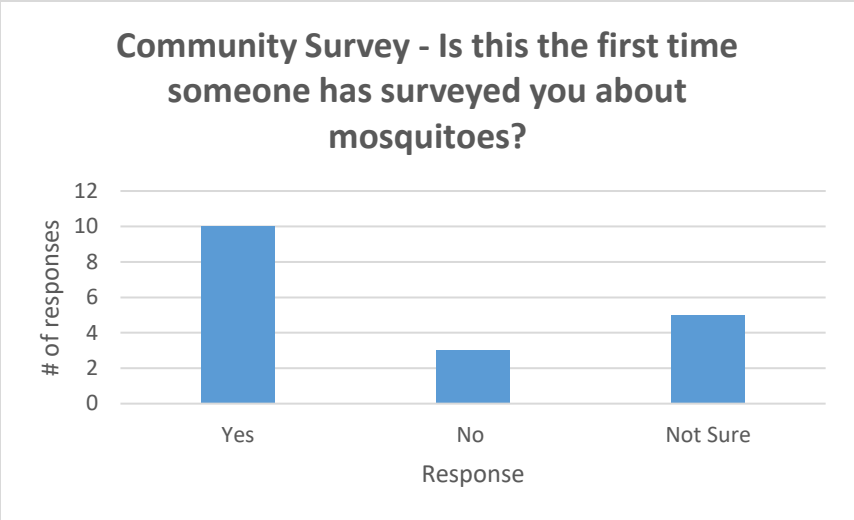
Which questions could you graph?

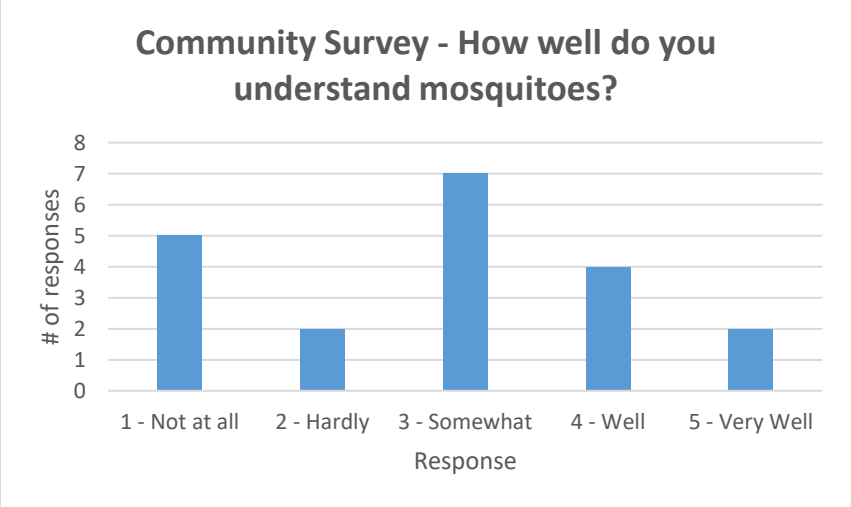
View the Task 2-4 graph examples

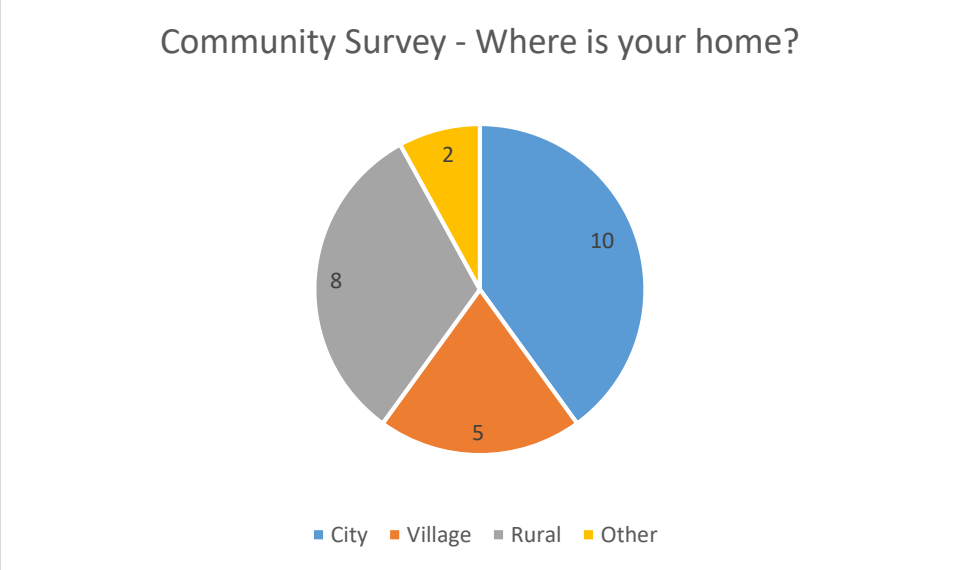
If you have the resources, pick some questions to graph that you think would be useful.

How would these graphs be useful when supporting claims with evidence?

Community Survey Graph Examples







Community Survey—Mosquito B

Use this survey to compile data.

Part 1: Background Information

Age:				
0-10	11-20	21-40	41-64	65+

Gender					
Male	Female	Non-binary/third gender	Prefer to self-describe: _____	Prefer not to say	

What town do you live in?

Is your home in the city, village, or rural?			
City	Village	Rural	Other

Availability of communication media in the house (check all that apply)			
Television	Newspaper	Radio	Computer
Tablet	Internet	Telephone	Mobile phone
SMS	Social media	Other	

Part 2: Community

Is this the first time someone has surveyed you about mosquitoes?		
Yes	No	Not sure

How well do you understand mosquitoes?				
1. Not at all	2. Hardly	3. Somewhat	4. Well	5. Very well

How concerned are you about mosquitoes in your community?				
1. Not at all	2. Hardly	3. Somewhat	4. Concerned	5. Very concerned

During the worst times of the year, how severe are the mosquitoes around your home?				
1. Not severe	2. Minimal	3. Average	4. Fairly severe	5. Extremely severe

During the worst times of the year, how many times do you get bitten by mosquitoes in a day?						
0 bites	1-5 bites	5-10 bites	10-20 bites	20-40 bites	40+ bites	

What impact do mosquitoes have on your quality of life?			
Health risk	Nuisance	No impact	Other

Go back to Research Guide now

4-5 Collecting Local Transmission Histories

In previous tasks, the team learned about some factors that affect the spread of mosquito-borne diseases. These factors include temperature, precipitation, disease hosts, and income.

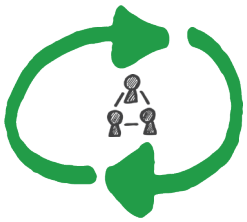
Objective

In this task, the team will explore some other factors that can affect the spread of mosquito-borne diseases in a community. The team will also work to understand how these factors have changed over time in the community. These factors include urbanization, natural disasters, deforestation, and changes in population. To understand how these factors have changed in your community, the team must talk to local people of various ages.

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

- What factors influence how mosquitoes develop and reproduce?
- What factors influence how mosquitoes spread disease?
- Who are local people, organizations, associations that can provide valuable information related to this problem?

1. Go to the Task 4-5 folder and get the Meet the Team reading. This reading includes the interview questions.
2. As a team, read the Meet the Team reading.
3. Outline three to five very important points from the reading. Share as a team.
4. Use the resources in the Learning Lab task folder to learn more about the effects of natural disasters and urbanization on mosquitoes.
5. Read the interview questions provided.
6. Decide which questions you will use during your interview.
7. Create any additional interview questions as a team.
8. Identify various people in your community that team members could interview.



4-5

9. Determine how you will document the responses of the people you are interviewing.
10. Conduct interviews with these people.
11. As a team, share and compile the results of these interviews.
12. As a team, discuss the following:
    - Based on your interviews, how has the urbanization of your community changed over time?
    - Has it become more crowded? Have many people moved there or moved away? Has human contact with animals increased or decreased?
    - Have any natural events, such as large storms, tornadoes, or hurricanes, happened in the area?
    - Have people become more or less healthy? How has their living situation changed for better or worse?
    - What are some limitations of these types of interviews?
    - How are interviews about the past different than data or evidence from the past?
    - How did the interviews shed light on the present? Write a few examples of current things that make more sense now than before you heard about the past.
    - How might these things, or other parts of what you heard, tie into the community's health?
    - How can the information from these interviews be useful when considering the problem question and other questions from the map?
    - What factors influence how mosquitoes develop and reproduce? What factors influence how mosquitoes spread disease?
    - Who are local people, organizations, associations that can provide valuable information related to this problem?
    - How can we ensure health for all from mosquito-borne diseases?

Research Tip

Use the field safety tips in the safety documents on Learning Lab before going out into the community to survey or interview people. Be polite, never go alone, and always be aware of your surroundings.

Task 4-5 Collecting Local Transmission Histories – Interview Questions

Use these questions to interview different people in your local community to learn more about its history.

1. Was our community always as crowded as it is now?
2. In your opinion, how has the community's health changed as a result?
3. Have many people moved here or moved away during your life? Were there ever any large events of immigration or emigration?
4. Has the community become more urban over time? How do you think the community's health has changed as a result?
5. Has the community built more homes or buildings over your life?
6. What roles do animals play in the community and how has this changed over time?
7. Have people been in contact with wildlife in your community during your life?
8. Has this contact changed over time?
9. Has the way land is used in the community changed during your life?
10. Has wild land in the community been cleared for agriculture during your life?
11. Have any unusual natural events, like large storms or strange seasons, occurred during the time that you have been here, and did they cause any changes in the community's health or the amount of mosquitos you noticed?
12. When you were younger, do you remember being bitten by mosquitoes more or less often than now?
13. Could you please describe any changes in your lifestyle or in the community that could be responsible for this?
14. Have guests always visited the community and where do they usually come from?
15. Has access to clean drinking water, electricity, and roads always been the same?
16. Create your own questions:_____

Go back to Research Guide now

Mosquito! Task 4-5 Collecting Local Transmission Histories

Learning about the changes to a place from the local people

Kelly Bennett - Biologist - Smithsonian Tropical Research Institute (Panama)

Mosquito-borne diseases like dengue, Zika, and yellow fever are emerging and reemerging all over the globe. The emergence of these diseases can be connected to urbanization and changes in land use over time. Urbanization is an increase in the number of people and a change in the way land is used in an area over time. As the number of people in a location changes, things like land use and contact with wildlife can change. These changes can affect the spread of mosquito-borne diseases in a community.

The problem of mosquito-borne disease has also been affected by increased human movement and trade around the world. Over time, this movement allows mosquitoesto travel and establish new populations. In addition, urbanization can increase contact people have with the surrounding forests. Over time, this contact is where diseases can switch from using animals as hosts to using humans as host. Increasing urbanizationof communities means we must work together when thinking about this problem. Mosquitoes can be highly adaptive. New mosquito-borne diseases are emerging and spreading rapidly. A recent example is Zika virus. This disease has been around for along time. However, it has only recently become a worldwide problem. This is likely dueto the adaptive nature of *Aedes* mosquitoes, which are able to take advantage of their association with humans.

To fully understand urbanization and changes in a community over time, we have to start to uncover its history. For some things, this can be hard to do. Big histories, like those of nations, are often written down and are easy to find. Smaller histories, on the other hand, like those of towns, families, or events, are usually recorded in our memories and passed down through stories. This gives personal stories of the past, passed from one generation to the next, big value. They help us understand our current situation in ways that other methods cannot.

In this task, you will interview elderly members of your community to learn about the past. From this history, your will work to better understand the urbanization and changes of your community over time.

When you do your interviews, try to interview some people your parent's age, and some who are even older. The point is to see how things have changed over time.

In your interviews, try to listen much more than you talk, but still remain an active listener. Keep an ear out for themes like urbanization, globalization, contact with wildlife, natural events, health, and development. Understanding how these things have become the way they are will help you keep your community healthy.

Below are some questions to use in your interviews. Feel free to come up with more, especially ones that are specific to your area, but see these as a framework to follow.

How you set up an interview is your choice. If you aren't sure what to do, simply explain the project you are working on and politely ask your interviewee if they would be willing to tell you about the past of this place. It is best to meet someone in a space where they feel comfortable, and to start with some simple questions to let them warm up. Then, when they seem open to sharing stories, you can ask them the following **interview questions**.

- Was our community always as crowded as it is now?
- In your opinion, how has the community's health changed as a result?
- Have many people moved here or moved away during your life? Were there ever any large events of immigration or emigration?
- Has the community become more urban over time? How do you think the community's health has changed as a result?
- Has the community built more homes or buildings over your life?
- What roles do animals play in the community and how has this changed over time?
- Have people been in contact with wildlife in your community during your life?
- Has this contact changed over time?
- Has the way land is used in the community changed during your life?
- Has wild land in the community been cleared for agriculture during your life?
- Have any unusual natural events, like large storms or strange seasons, occurred during the time that you have been here, and did they cause any changes in the community's health or the amount of mosquitos you noticed?
- When you were younger, do you remember being bitten by mosquitoes more or less often than now?
- Could you please describe any changes in your lifestyle or in the community that could be responsible for this?
- Have guests always visited the community and where do they usually come from?
- Has access to clean drinking water, electricity, and roads always been the same?

Articles for Task 4-5

Harvey's Next Danger: Massive Mosquito Clouds
Description:
After the catastrophic devastation of hurricane Harvey, the people of Texas are now facing a slew of problems from contaminated floodwaters to toxic mold to giant alligators sneaking into homes to floating rafts of fire ants. But as Joe Hanson at *Texas Monthly* reports, Harvey victims have yet another galling problem to add the mix: giant clouds of mosquitoes.
http://www.smithsonianmag.com/smart-news/harveys-next-disaster-giant-clouds-mosquitoes-180964786/

The World's Megacities Are Making Dengue Deadlier
Description:
While the world's attention is focused on the Zika virus spreading through the Americas, large urban areas in Southeast Asia are fighting off outbreaks of dengue fever.
http://www.smithsonianmag.com/science-nature/worlds-megacities-are-making-dengue-deadlier-180958009/

Protecting Land in Brazil Reduces Malaria and Other Diseases
Description:
In the Brazilian Amazon, getting back to nature may really be the healthiest option. Data covering hundreds of municipalities show that people who live near areas under strict conservation protection experience lower incidences of common diseases and infections such as malaria.
http://www.smithsonianmag.com/science-nature/protecting-land-brazil-reduces-malaria-and-other-diseases-180955604/

5-2 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.

Objective

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.

Citizen Science Tip

If your team has access to technology, such as a smart phone or tablet, consider how you could use the GLOBE Mosquito Habitat Mapper app to share your local data with scientists around the world.

- 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 mosquitos 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

GLOBE Observer
mosquito habitat mapper

Task 5-2 Tutorial

Mosquito Habitat Mapper

INSTITUTE for GLOBAL ENVIRONMENTAL STRATEGIES

The GLOBE Program

COMBATING ZIKA AND FUTURE THREATS
A GRAND CHALLENGE FOR DEVELOPMENT

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.

Mosquito Habitat Mapper

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.

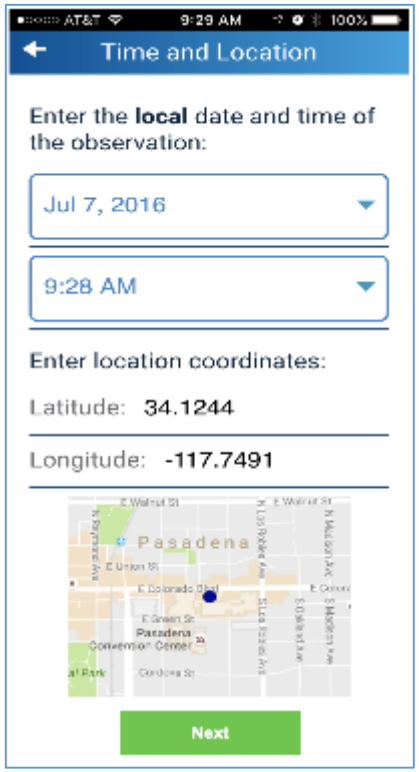
GLOBE Stats

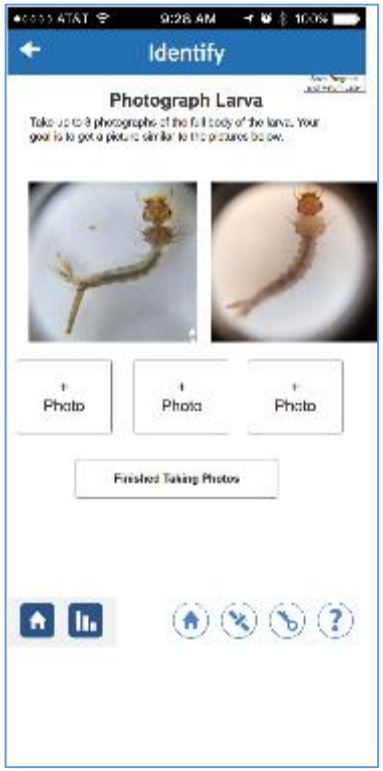
117	Countries
30,776	Schools
28,193	Teachers
141,856,866	Measurements
518,056	Measurements this month

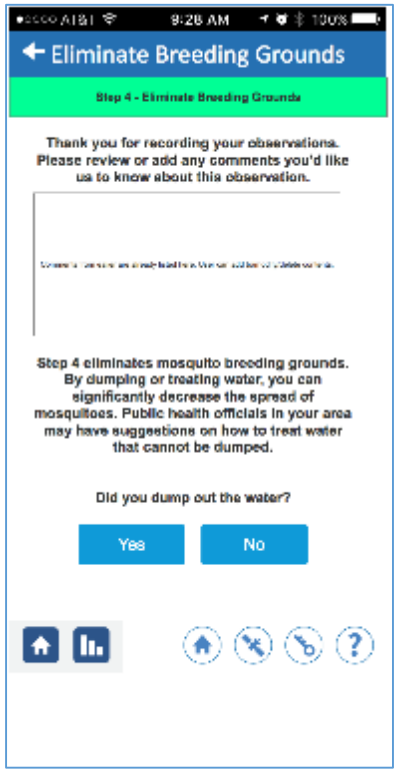
- **The goals of the MHM app are to SEE increased mosquito awareness and decreased mosquito-borne disease risk through:**
- **Scientific data collection and analysis**: Identifying locations of mosquito taxa of interest to participants, communities, public health authorities
- **Empowerment**: Actively 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:**





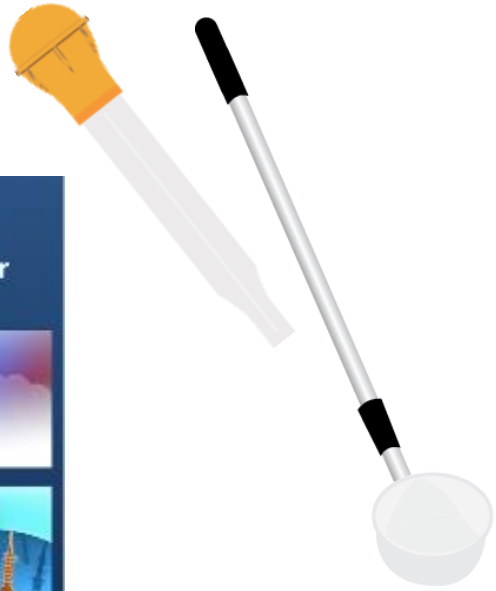


Locate → **Sample/Count** → **Identify** → **Decommission**

1 **2** **3** **4**

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.

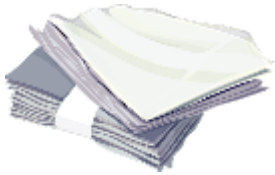


- **Mosquito dipper, ladle, cup or bulb syringe (or a net, bucket, and wash bottle)** for sampling. (Contact your local mosquito control authority for any recommendations)

- **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

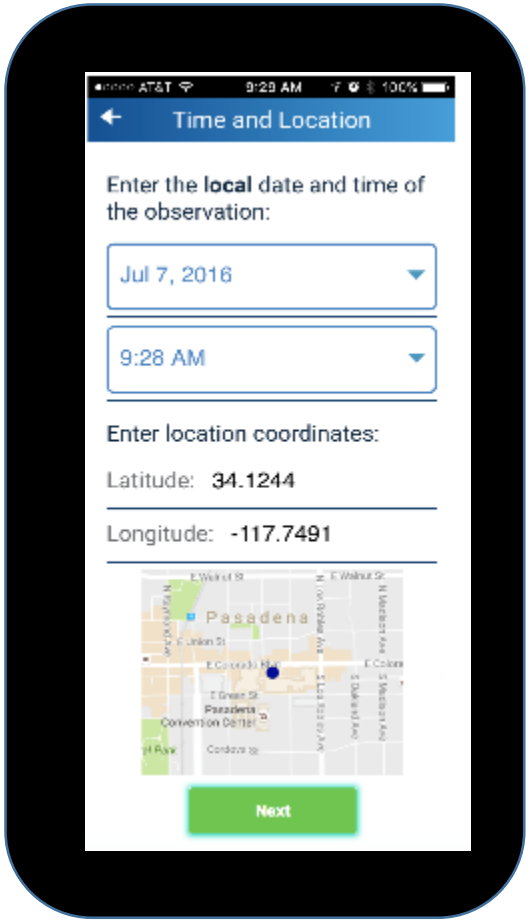
Step 1. Locate Breeding Sites

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.

Indoor containers

Outdoor containers

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.

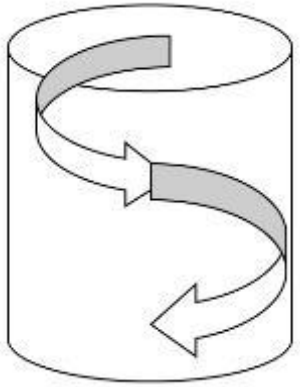
Steps:

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 througha 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

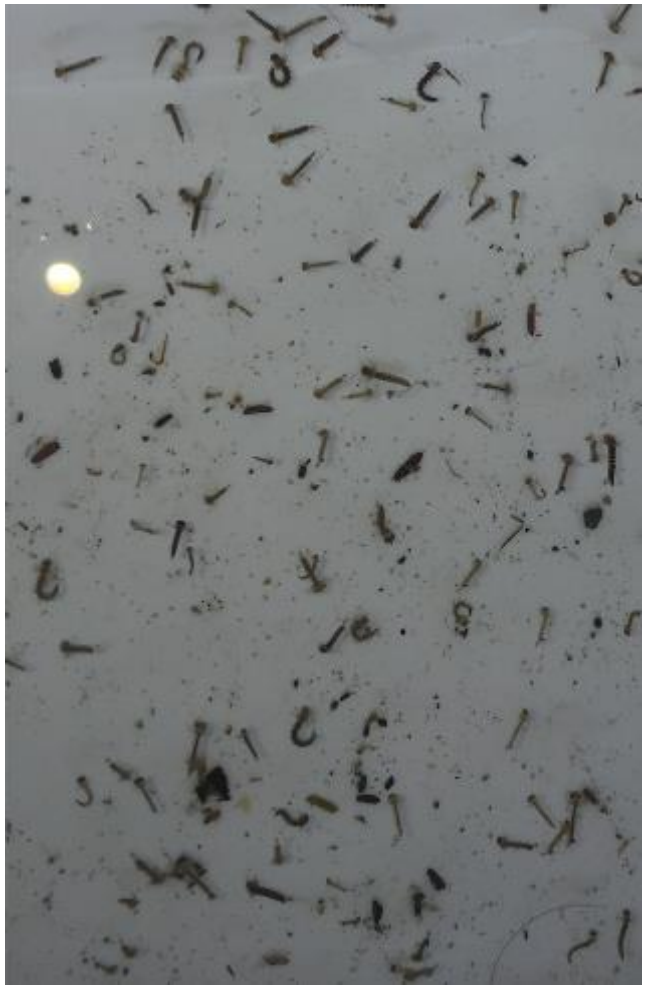
- You may want to take your sample inside to identify your specimen
- Leave air in bags so that larvae can breathe.
- Keep bags cool and in the shade (overheating will kill larvae).
- Identify the larvae soon after collection. If left overnight, any pupae in the sample may become adult flying mosquitoes.
- 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.

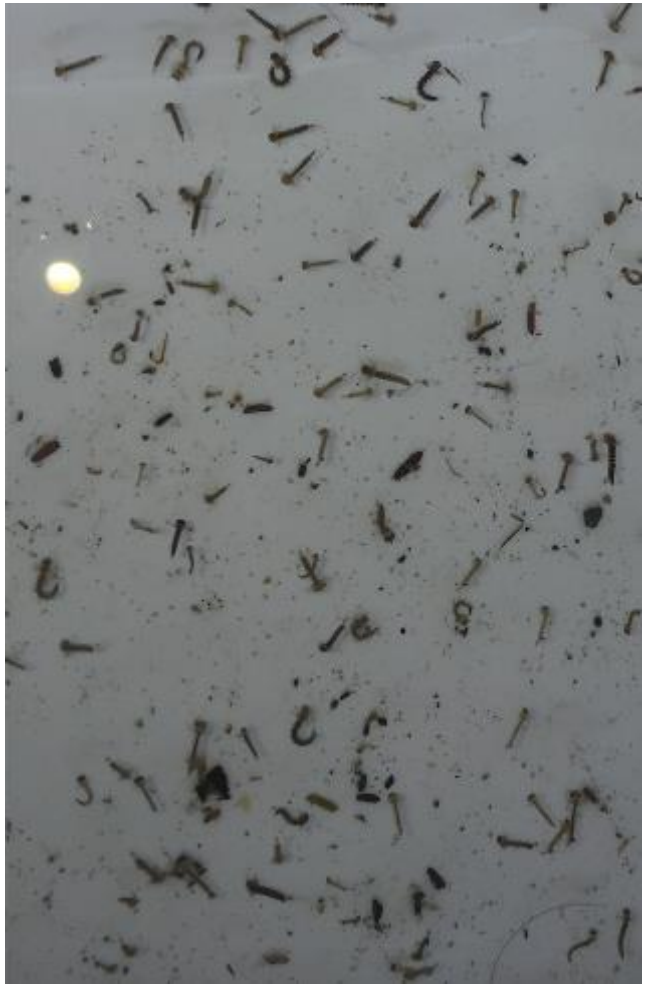
Using this same sample photo, it is important to note that not all of the larvae look the same. Why do you think they are different?



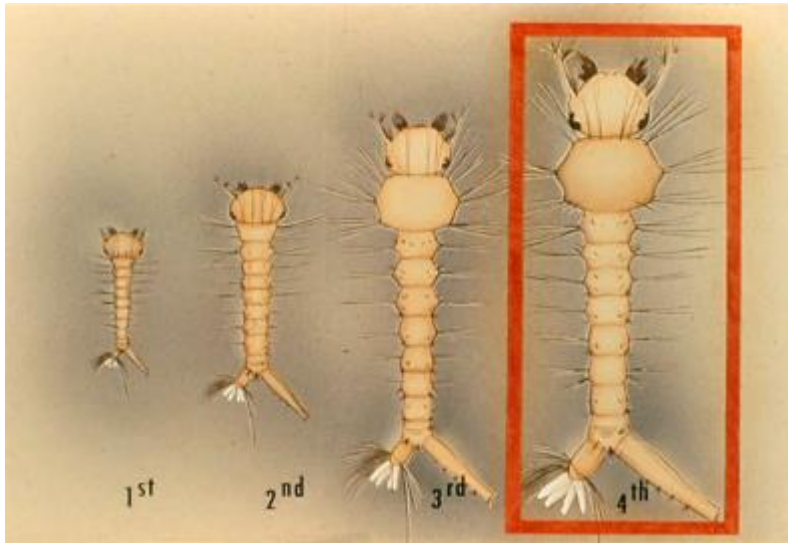
(Answer)

This sample has larvae from different stages of development.

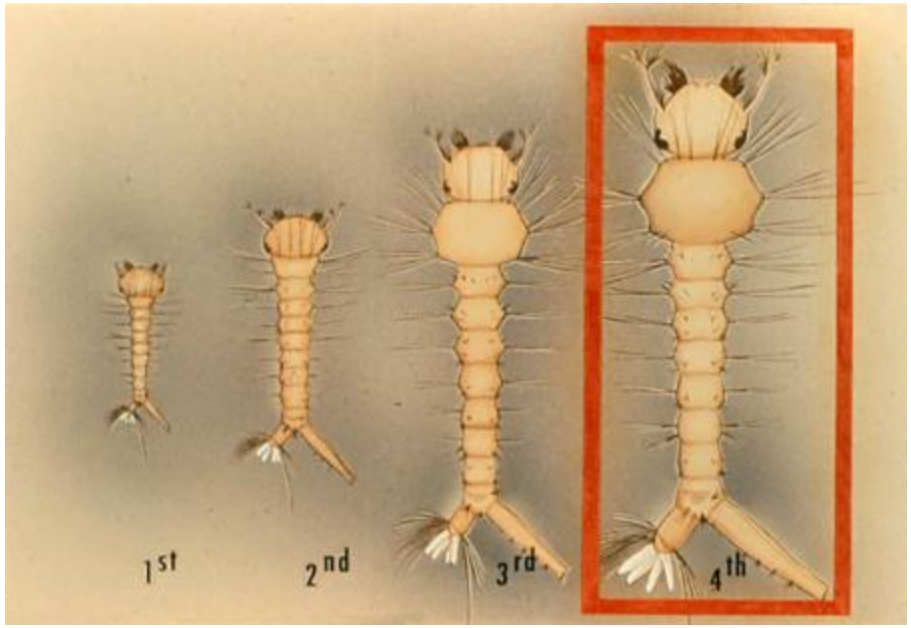
We will show you what we mean in the next few slides.



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 **4th 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.

Photograph and Identify-5

- Attach a macro lens to a mobile device so that you can take a picture and upload it to the app.

Photograph and Identify-6

- 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.

Photograph and Identify-7

- 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.

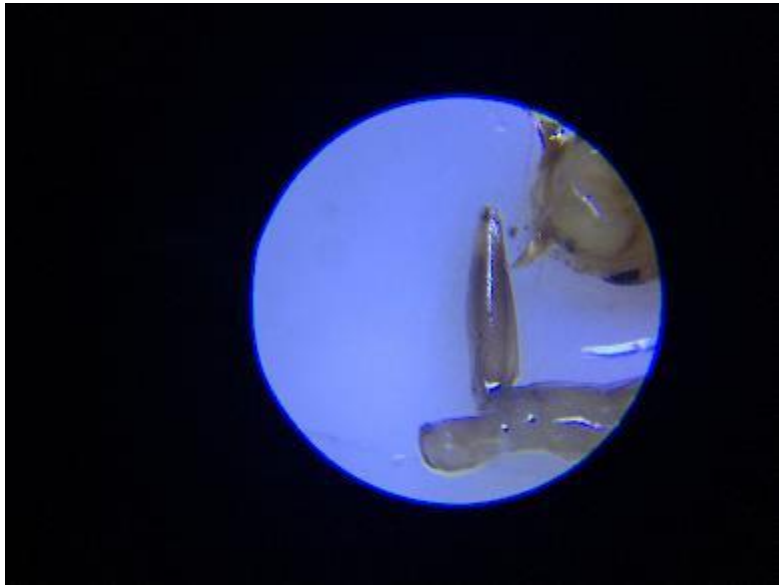
The collar helps you find the focal length that is ideal for looking at your specimen.

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.

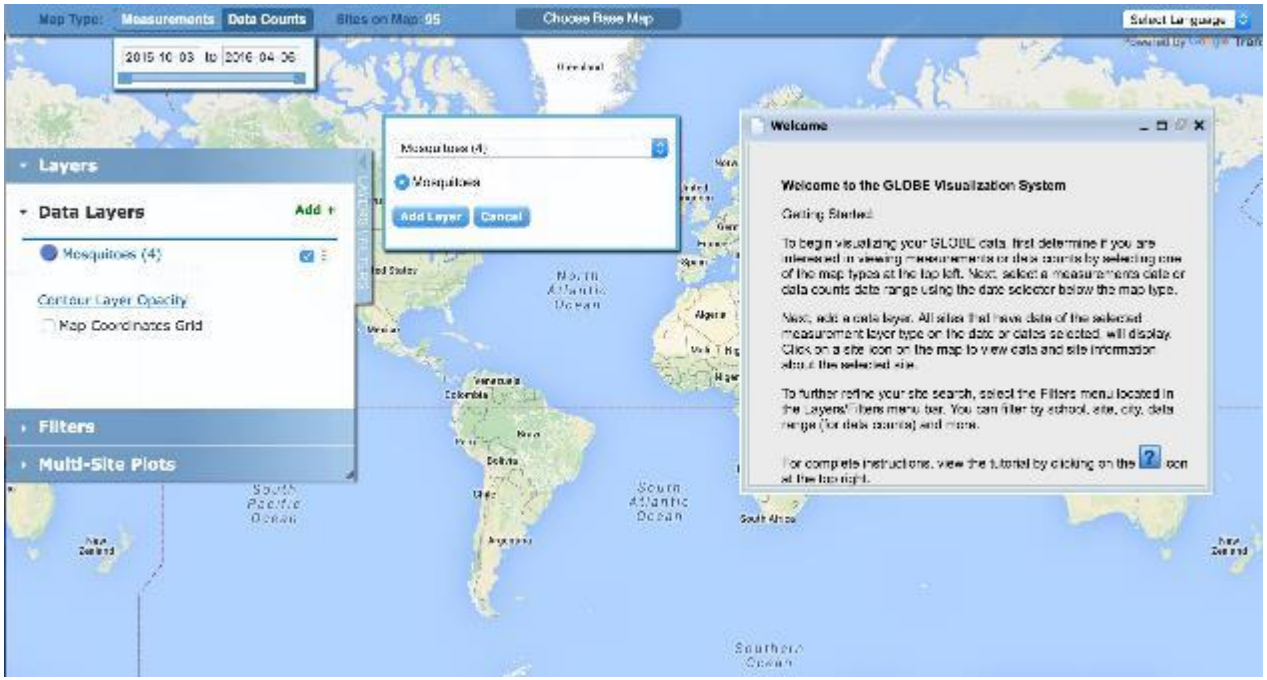
Step 4: Decommission the breeding site

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

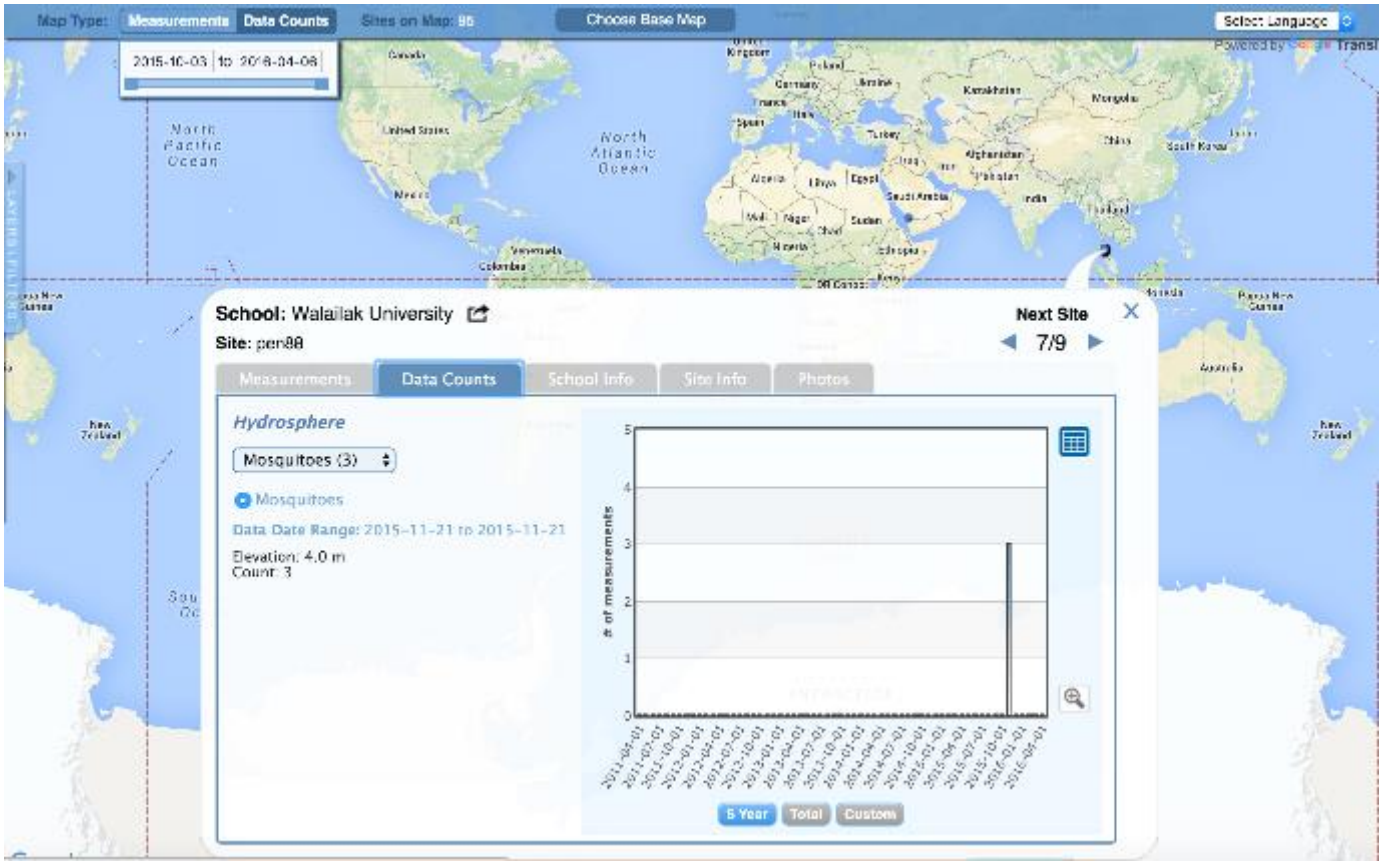
GLOBE provides the ability to view and interact with data measured across the world. Use our visualization tool to map, graph, filter and export data that have been measured across GLOBE protocols since 1995. The Mosquito Protocol is new- so we look forward to seeing your data!



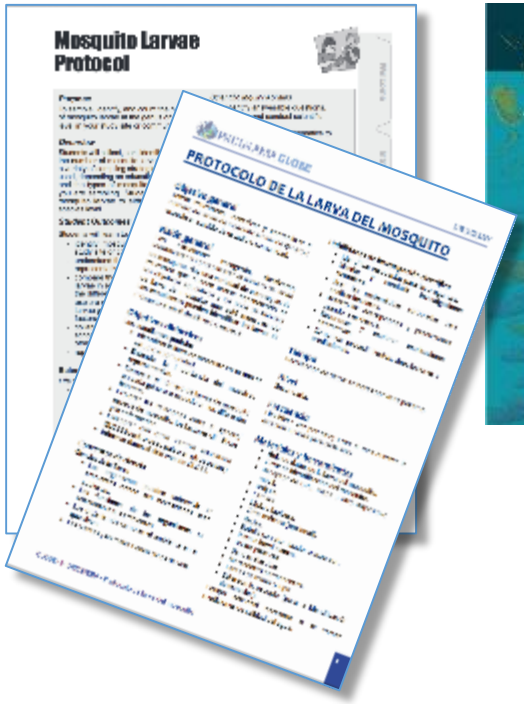
Link to step-by-step tutorial on using the GLOBE Data Visualization Tool

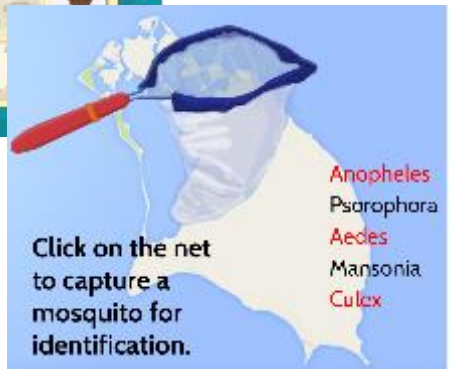
Visualize and Retrieve Data-2

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 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.

Frequently Asked Questions (FAQs-2)

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

The **GLOBE Observer Mosquito Habitat Mapper** is a NASA-sponsored project that is the result of the combined efforts of an extended team that includes the Institute for Global Environmental Strategies (IGES); NASA Goddard Space Flight Center, Langley Research Center, and Jet Propulsion Laboratory; Space Science Applications, Inc. (SSAI); the GLOBE Implementation Office (GIO), GLOBE DIS and Brooklyn College.

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. www.globe.gov

INSTITUTE for GLOBAL ENVIRONMENTAL STRATEGIES

The GLOBE Program

COMBATING ZIKA AND FUTURE THREATS
A GRAND CHALLENGE FOR DEVELOPMENT

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.

Habitat	Number found	Found water in habitat (yes or no)	Description of water clarity (clear to dirty)	Description of water movement (still or stagnant to fast-moving)	Habitat exposure (sun, shade, semi-shade)	Found eggs, larvae or pupae in water
Cans, bottles, jars						
Pots and containers for flowers or plants						
Old tires						
Bird baths						
Roof gutters						
Drainage pipes around buildings						
Trash						

Tarps, plastic bags						
Old cars						
Boats, canoes						
Dripping outdoor faucets or window air conditioners						
Wheelbarrows						
Garbage cans, recycling bins, other barrels						
Low spots on ground						
Tree stumps						
Tree holes						
Rain barrels						

Go back to Research Guide now

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

Go back to Research Guide now

Mosquito! Task 5-2 Identifying + Mapping Local

The Importance of Local Mosquito Monitoring

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.

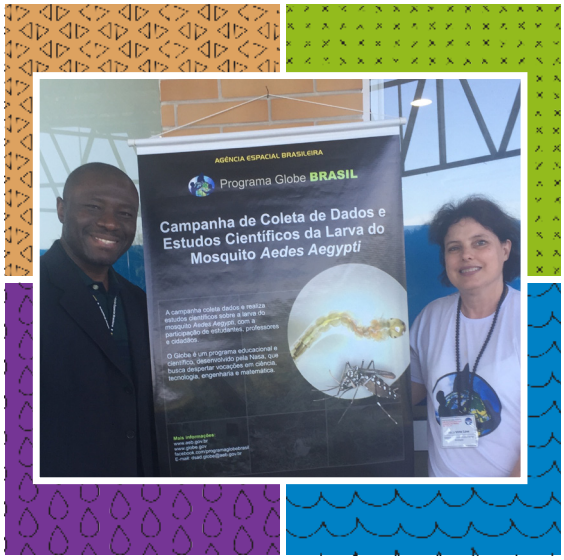
I read about the history of mosquitoes and the efforts to eradicate disease in places like the United States at the turn of the century. There are many success stories, all before we had pesticides to kill mosquitoes. So I wondered if we could use the power of the "crowd in the cloud" to better get a 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/CupKTlql1vc

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/ENoalx26LIk

NASA Using Satellite Data
https://www.nasa.gov/feature/goddard/2017/using-nasa-satellite-data-to-predict-malaria-outbreaks

6-3

Creating Local Integrated Management Plan

In Task 6-2, the team created integrated management plans for simulated cities. These plans outlined ways for a community to manage mosquitoes and mosquito-borne diseases. It is important to create a management plan that is specific to your location. It is also important to create a management plan that combines a variety of methods. Combining together multiple methods helps address all the different perspectives of the problem (social, economic, environmental, ethical). A plan that combines many different methods is called an integrated management plan (IMP).

Objective

In this task, the team will create a variety of integrated management plans for your local community. Using the list of management methods from Task 6-2, the team will develop a variety of IMPs for different budgets (wealth units). From these scenarios and budgets, groups will make suggestions for how the local community should develop their integrated management plan.

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

- What are the social, environmental, economic, and ethical considerations of various mosquito management and control plans?

1. Go to the Task 6-3 folder and get the list of management options. There is only one version of this task.
2. Read through the list of management options.
3. Note the wealth units for each management option.
4. Divide the team into groups, individuals, or work together as a whole team.

6-3

5. Using the list of management options, create three integrated management plans for your local community, using the following budgets.
   - 150 wealth units
   - 100 wealth units
   - 50 wealth units
6. For each plan, determine how you are addressing the different perspectives of the problem (social, economic, ethical, environmental).
7. As a team, discuss the following:

- Share and discuss your integrated management plans for your community.
- Provide the reasoning for why you selected the methods for each budget level.
- Compare and contrast plans from different groups.
- Based on your plans, 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 you best communicate this plan to local community members? Be creative and think about a communication plan that you think would work for local people.

Hooray! You completed Task 6-2. Check it off the task list. *Go to Task 6-3!*

Task 6-3 Creating Local Integrated Management Plans

Mosquito Management Options

(Create your integrated management plan from the items on this list.)

Spray Pesticides

- Use larvicides to target mosquito larvae in water storage containers and other manufactured and natural habitat sites (cost = 15 wealth units)
- Use adulticides to target adult mosquitoes (cost = 15 wealth units)

Conduct Surveillance

- Regularly monitor water storage containers and identified mosquito habitats throughout city (10 wealth units)
- Regularly monitor mosquito population numbers and types throughout city (5 wealth units)
- Regularly monitor mosquito eggs on imported manufactured goods (such as used tires, water storage basins, and disposable plastic containers) across major seaports of the country (10 wealth units)
- Regularly monitor water storage containers and identified mosquito habitats throughout human neighborhoods located near major seaports of the country (10 wealth units)

Disrupt the mosquitoes' ability to breed

- Improve street cleaning and garbage services throughout the city (5 wealth units)
- Improve water storage and supply services throughout the city (15 wealth units)
- Regularly clean identified mosquito habitats throughout the city (10 wealth units)

Use biological controls

- Introduce mosquito-eating fish and copepods into water storage containers 10 wealth units)
- Introduce genetically modified mosquitoes into the city (15 wealth units)
- Introduce *Wolbachia*-infected mosquitoes into the city (10 wealth units)

Trap mosquitoes

- Set out and maintain mosquito traps throughout the city (10 wealth units)
- Set out and maintain mosquito traps throughout the major seaports (10 wealth units)

Individual and household control

- Install window and door screens on all buildings (10 wealth units)
- Cover all beds with mosquito netting (15 wealth units)

Education and public outreach

- Increase public education programs throughout the city to teach about personal protection and city-wide management strategies being used to control mosquitoes (15 wealth units)
- Increase communication with the public throughout the city using educational billboards, social media campaigns, and public service announcements to build mosquito awareness (5 wealth units)

Government and Policy Updates

- Create new government policies to help poverty-stricken areas affected by mosquito-borne diseases in the city (5 wealth units)
- Develop tax incentives for people, organizations, and companies that help clean up mosquito habitats around their properties (10 wealth units)
- Create or update policies on education and research about mosquitoes in the local community (10 wealth units)

Research

- Fund new research on mosquitoes and new mosquito management technology for the city (5 wealth units)
- Fund increased research on the social and economic components of the mosquito problem in the city (5 wealth units)

Go back to Research Guide now

7-2 Developing Part Two of the Community Action Plan: Action Goals

In Task 7-1, you assembled and organized all of the research you have already completed. It is one thing to do research and another to set local goals to help people take action on that research. It will be important to use the information you collected to figure what your future actions will be to help address the problem question: How can we ensure health for all from mosquito-borne diseases?

There are many possible solutions to this question. This is why we must now develop action goals for what to do next.

Objective

In this task, the team will assemble the second part of their community action plan. This part involves developing actions you think people should begin taking in the community to address the problem question.

1. Go to the Task 7-2 folder to read the details about assembling part two of the action plan: Action Goals. There is only one version of this task.

2. Read through the details of the second part of the action plan again as a team. Ask questions about any parts that are not clear. Remember not to worry.

3. Use all of the work you have completed up to this point to assemble and organize this part of your action plan for the community.

Hooray! You completed Task 7-2. Check it off the task list. *Go to Task 7-3!*

Task 7-2 Developing Part Two of the Community Action Plan: Action Goals

The team will continue developing your action plan. Overall, this action plan will outline how you will address and communicate the problem question: How can we ensure health for all from mosquito-borne diseases?

The Community Action Plan will have three parts. Tasks 7-1, 7-2, and 7-3 will help you complete each part of the plan.

1. Task 7-1: Research area background, evidence collected, integrated management plan developed (This part involves organizing what you have already completed during your research.)
2. Task 7-2: Action goals (This part involves figuring out what you will do now, after your research is completed.)
3. Task 7-3: Communication strategy (This part involves telling people about your research, action goals, and plan.)

This task will focus on assembling the action goals of the Community Action Plan. This involves developing the actions you think people should begin taking to address the problem question in your community. Complete the following, based on the research you have conducted.

It is one thing to have an integrated management plan and another to set local goals to help people act on that plan. For example, part of your plan could be to empty the water from all containers in an area. Another part of the plan could be to educate various people in your community about the problem. Setting local action goals will help you determine what actions need to be taken now and in the future, who is responsible for taking them, and how the actions will be monitored to determine their effectiveness over time.

1. Develop a list of action goals that could be carried out by various people in your community to work toward different parts of your integrated management plan. Consider the following when creating your action goals: What type of action is needed and what is the action meant to address? Provide a description of the action. Some examples include:
    - **a.** Education action goals: Create and hand out brochures to educate the community about mosquitoes. This action will increase local knowledge and actions of community members concerning mosquitoes and mosquito management.
    - **b.** Advocacy action goals: Create posters to advocate for a group of people at risk from mosquitoes. Write letters to local officials and community leaders concerning mosquitoes and the effect on different people and groups in your community.
    - **c.** Physical action goals: Conduct weekly monitoring of your research site for standing water where mosquitoes could breed. This action will reduce the

number of possible breeding sites mosquitoes can use in the community. Document and remove any standing water found in the site every week throughout year.

   d. Be creative and develop your own goals for your community!

2. Who is responsible for the action: yourself, team member, team, specific community member(s), all community members?
3. Action schedule or timeline: When and how often does the action need to take place?
4. Action monitoring: How will the action goals be documented or monitored over time to determine their effectiveness? How will you determine whether the action is working effectively? Create a strategy to monitor these goals over time.
5. Order the actions: If you have a list of action goals, which ones would you recommend be done first, second, and third? Create an order for all of your actions, so the team knows where to start.

Go back to Research Guide now

7-3 Creating Part Three of the Community Action Plan: Communication Strategy

In Tasks 7-1 and 7-2, you assembled and developed parts one and two of your plan. However, if no one outside of your research team knows about your plan, can it make an impact? No way! Next, you will need to develop a plan to creatively communicate your action plan with your community.

There are many possible ways you can communicate with your community. Be creative!

Objective

In this task, the team will assemble the third part of their community action plan. This part involves creating a communication strategy to communicate your plan to others.

1. Go to the Task 7-3 folder to read the details about assembling part three of the action plan: Communication Strategy. There is only one version of this task.

2. Read through the details of the third part of the action plan again as a team. Ask questions about any parts that are not clear. Remember not to worry.

3. Use all of the work you have completed up to this point to assemble and organize this part of your action plan for the community.

Hooray! You completed Task 7-3. Check it off the task list. *Go to Task 7-4!*

Task 7-3 Creating Part Three of the Community Action Plan: A Communication Strategy

The team will continue developing your action plan. Overall, this action plan will outline how you will address and communicate the problem question: How can we ensure health for all from mosquito-borne diseases?

The Community Action Plan will have three parts. Tasks 7-1, 7-2, and 7-3 will help you complete each part of the plan.

1. Task 7-1: Research area background, evidence collected, integrated management plan developed (This part involves organizing what you have already completed during your research.)
2. Task 7-2: Action goals (This part involves figuring out what you will do now, after your research is completed.)
3. Task 7-3: Communication strategy (This part involves telling people about your research, action goals, and plan.)

This task will focus on creating a communication strategy for the Community Action Plan. This part involves communicating any and all parts of your plan with your community. Complete the following, based on the research you have conducted.

If no one outside of your research team knows about your plan, can it make an impact? Of course not! So you will need to develop a plan to creatively communicate parts of your action plan to your community. Make sure you include Social, Ethical, Economic, and Environmental perspectives on the problem. How will you educate others about your evidence, claims, decisions, and action goals?

Be creative. This plan can include:

- Making posters or art projects to communicate parts of your plan.
- Writing a song or a one-act play to communicate parts of your plan.
- Writing and recording a public service announcement (audio or video) to communicate parts of your plan.
- Creating a social media campaign to communicate parts of your plan.
- Come up with your own ideas!

After you have developed your communication strategy, you will need to share with and present this information to local community members. This group can include parents, educators, administrators, residents, and other team members.

Each group should include the following when communicating with community members.

- Present Social, Ethical, Environmental, and Economic considerations for the community.
- Support all claims with evidence (data and statistics, expert opinion, personal and secondhand experience) within the plan.
- Support all suggested actions using claims and evidence.
- Clearly explain, demonstrate, and illustrate parts of your integrated management plan.
- Clearly explain, demonstrate, and show all aspects of your action goals.
- Clearly outline how the plan would be monitored for effectiveness over time. Discuss how the plan can be adjusted if it is not working or needs to be improved.

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Zika Awareness and Prevention (ZAP) Game

The Zika Awareness and Prevention (ZAP) Game was developed to strengthen students and communities in their ability to stop Zika virus disease. Zika virus is a mosquito-borne virus, spread primarily by the bite of an infected *Aedes* species mosquito. Through simulation, this game educates students about Zika virus, common mosquito breeding sites, Zika virus disease symptoms, and pregnancy risks associated with Zika. Practices that help to prevent mosquito bites are also covered such as using an EPA registered insect repellent with DEET, the importance of wearing long sleeved shirts and long pants when outdoors, and treating clothing with permethrin. Multiple choice and matching games are provided to gauge how much you learned about Zika.

Use the following link to access the game, and have fun!
http://zika.vmasc.odu.edu/zap/

Computer WebGL Compatibility: Chrome 64 bit Version 57 and newer, Microsoft Edge version 16 or newer, Safari version 11 or newer, and Firefox version 52 or newer. Firefox users check your privacy settings.

For more information about the ZAP Game or for any other concerns please email us at Zapzika@odu.edu or contact:

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Team News Articles for Task 7-3

Zika ZAP Game News Article
https://www.odu.edu/news/2017/6/zika_game#.WzE7aadKiUk

Rusty Low News Article -USAID
https://medium.com/usaid-2030/arming-citizen-scientists-with-an-app-to-identify-zika-carriers-f8af4ff7391d

Kelly Bennett STRI News Article
https://newsdesk.si.edu/releases/smithsonian-scientists-track-aedes-mosquito-invasions

Lee Cohnstaedt USDA News Article 1
http://www.fox5dc.com/news/local-news/md-students-taking-part-in-research-project-to-help-track-mosquitos-that-may-carry-zika

David Pecor WRBU News Article
https://insider.si.edu/2016/06/smithsonians-mosquito-collection-weapon-battle-zika/

Lee Cohnstaedt News Article 2
https://www.denverpost.com/2016/05/16/usda-wants-citizen-scientists-to-help-fight-zika/

Invasive Mosquito Project Link
http://www.citizenscience.us/imp/