Welcome to Part Six: Management, and Task 6-1. In Part Five you learned more about where mosquitoes live and breed. Now, the team will begin learning more about the different mosquito management and control strategies.

Objective

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?

There are many different methods to manage mosquitoes in your community. Not every method is appropriate for your location. There are many arguments for and against each strategy. You must consider all of the options before making decisions about what you think a community should do. In this task, the team will be learning about different mosquito management options. The team will also start to determine the social, environmental, economic, and ethical considerations of the different options.

1. Go to the Task 6-1 folder and get the Meet the Team reading. There is one version of this task.

2. Each team member can read the entire reading, or you can form groups and split the reading up. Each group should read about one researcher. Then, each group will share information on the management method discussed by the researcher they read about.
3. When reading and presenting to the team, complete the following.
   • Briefly describe the management method and any Very Important Parts (VIPs),
   • Describe some arguments for and against each method.
   • Are there any social, environmental, economic, or ethical perspectives that should be considered when thinking about this management option?

4. As a team, discuss the following questions:
   • Imagine you are creating a mosquito management plan for a city. This city has a certain amount of money to spend. Do you think it is better to spend all the money on just one management method or spread the money across a variety of different methods? Why?
   • How does understanding different management methods help when thinking about the problem question: How can we ensure health for all from mosquito-borne diseases?

Hooray! You completed Task 6-1. Check it off the task list. Go to Task 6-2!
What are different options for managing mosquitoes?

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There are many different strategies to consider when managing mosquitoes in your community. Not every strategy is appropriate for your location. There are many arguments for and against each strategy. You must consider all of the options before making decisions about what you think the community should do.

One strategy to consider is **conducting regular surveillance**. Conducting surveillance means tracking the number and types of mosquitoes throughout the year in your location. You may have noticed that the number of mosquitoes in your location changes from month to month. Conducting surveillance throughout the year can help you understand how these numbers change. Surveillance must also be conducted on the local habitats mosquitoes are known to use for living and breeding. You can then use this information to make decisions about when to take action, such as using pesticides, cleaning streets, or draining water from storage containers.

By conducting surveillance, you can monitor the actual situation as it changes. Then you can identify the appropriate time to take action. This targeted action can possibly save your community money over time.

However, the people conducting the surveillance need a certain level of background knowledge on mosquitoes. If local people are not trained, then you will have to spend time and money training these people. Also, if the surveillance is not good, it may delay the appropriate action until it is too late. This could lead to more problems. There are many ways surveillance can be a helpful method. Think about how this could be useful for your local community.
There are many different strategies to consider when managing mosquitoes in your community. Not every strategy is appropriate for your location. There are many arguments for and against each strategy. You must consider all of the options before making decisions about what you think the community should do.

One strategy to consider is **trapping and collecting mosquito eggs and adults**. Trapping and collecting mosquito eggs and adults involves luring them to a place where they can be captured. There are many different methods and designs for luring and trapping mosquito eggs and adults. New designs are always being created. Traps can be used around homes, buildings, or habitats to traps mosquito eggs and adults before they get to humans. The traps could also be used as part of research or surveillance of your community. Be creative and think about ways you can trap mosquitoes in your area.

Then, think about what you could do with the mosquitoes after they are captured. Traps can be used to collect and track the number and types of mosquitoes throughout the year in your location. This information could also be used to create a map of your community showing where the mosquitoes like to live. Experiment with different trap designs to see what works best in your location at different times of the year. Think about how these collected eggs could be used to manage the problem in your community.

However, it is important to know that it is currently not possible to trap all of the mosquitoes in a large area. It requires many traps to get mosquitoes. Maintaining and surveilling these traps is also very labor-intensive. This can make trapping more expensive for a community. You must weigh all of your options when making decisions about what you think a community should do.
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There are many different strategies to consider when managing mosquitoes in your community. Not every strategy is appropriate for your location. There are many arguments for and against each strategy. You must consider all of the options before making decisions about what you think the community should do. Two strategies to consider are government policy and individual/household prevention methods.

**Individual/household prevention methods** are things a person can do for themselves or their home and family. These methods will help prevent people from being bitten by mosquitoes. An example of an individual prevention method is using insect repellent when you are outside. Insect repellent will reduce the number of mosquitoes that want to bite you. Another method is wearing clothes that cover your skin when outside. Reducing the amount of skin exposed helps reduce the number of mosquito bites.

Household prevention methods include covering windows and doors with screening to prevent mosquitoes from entering. Reducing the number of mosquitoes inside the home can reduce the number of mosquito bites. Another prevention method is using netting over all beds in the home. Since many mosquitoes like to bite during the night, this can prevent the number of mosquito bites as you sleep. Using insecticide-treated bed netting is also another option to consider to further prevent mosquito bites.

New prevention methods are being researched every day. All of these individual and household prevention methods are intended to keep mosquitoes off of a person. However, these methods depend on each person being responsible for doing the method. If not everyone in a home or community participates, it can be an unreliable method for prevention. These methods also do not control the mosquitoes, they only work to prevent being bitten. This is why it is important to think about developing a plan that has both prevention and control methods.

**Government policy** concerns the role of government programs in maintaining public health and safety from mosquito-borne diseases. Policies outline the course of action the government provides to make decisions about mosquito-borne diseases. Government policies help determine how the government will work and spend money with other local government agencies or health organizations. New policies can be created. Current policies can be updated and changed.

According to the local problem, the local government or organization uses guidance from policies to make decisions on the front lines of the problem. Policies on mosquito control and prevention can be created to help local communities get resources and money to carry out better individual/household prevention programs. Policies are also created on how to educate people about mosquitoes or how to control the number mosquitoes in a community. Policies can help bring resources and money to a community to address the problem.

However, creating policy can take time. Creating policy requires large amounts of research and discussion. This research and discussion helps determine the decisions to be made in the policy. This process can take longer if everyone does not agree on the policy. Also, the economic considerations of the policy must be discussed. All of this takes time, research, and effort. What suggestions could you make to local policy makers about the mosquito problem in your community?
There are many different strategies to consider when managing mosquitoes in your community. Not every strategy is appropriate for your location. There are many arguments for and against each strategy. You must consider all of the options before making decisions about what you think the community should do. Two strategies to consider are disrupting mosquito habitats and education and public outreach.

**Disrupting mosquito habitats** concerns focusing on the many ways to manage and control places where mosquitoes live and breed. By disrupting potential mosquito habitats, you can reduce the number of ideal places for mosquitoes to breed. There are many ways to disrupt the habitats of mosquitoes. Removing or dumping out standing water in habitats is one way. Cleaning streets and picking up garbage is another. Improving water storage and supply can also help disrupt potential habitats. Many of these control methods are easy for a community to start doing. Many of them are also nontoxic to the environment and safe for people in the community. They are also very effective if done correctly.

However, the effectiveness of these methods depends on the quality of participation by people in the community. If not everyone is participating, they are not very effective. Also, in many places it is not possible to drain all breeding areas, such as large natural water bodies. Recent research has also shown that draining natural water bodies can cause great harm to these environments. So we must think about the effects of each method before we do it. There are many ways to disrupt mosquito habitats. Think about which ways could work in your community.

**Education and public outreach** means public programs to teach the local people about the mosquito problem in your community. Understanding what your local community knows about mosquitoes is the first step. What have you learned about your community’s understanding of mosquitoes from the surveys you did? What types of things do you think they need to understand better? How could you communicate and teach local people about the importance of different management strategies?

Creating education programs for the public can be a very effective way to manage the mosquito problem. Teaching people about personal and home protection is one way. Educating people on the importance of different management strategies is another. For many of the methods to be successful, such as disrupting mosquito habitats, the entire community must be involved.

However, if everyone is not educated on the method, it will be very difficult to get all of the community to participate. Think about how you could educate or communicate the problem or methods with your community. How could you build awareness about parts of the problem in your community? Be creative. There are many ways to educate the public. Think about how you could combine this management method with others to address the problem of mosquito-borne diseases.
There are many different strategies to consider when managing mosquitoes in your community. Not every strategy is appropriate for your location. There are many arguments for and against each strategy. You must consider all of the options before making decisions about what you think the community should do.

One strategy to consider is **using pesticides**. Using pesticides is a common chemical method to control mosquitoes in a community. Pesticides are chemicals that kill mosquito larvae and adults before they can bite humans. Pesticides are usually sprayed in the air or water, or applied to the surfaces of buildings or outdoor areas. In many places, pesticides are easy to apply and can cover large areas, such as entire homes or buildings. This means they can protect large areas and large groups of people from getting sick.

However, some pesticides kill all insects and other animals in the area they are applied. This can include other insects and animals that do not harm humans. Depending on how they are sprayed, some pesticides can also drift into untargeted areas. These areas may contain people, food, or things that could be negatively affected by these chemicals or get into the food chain.

Being educated on how to use these chemicals is very important. In some places, the mosquitoes are now becoming resistant to the pesticides. This means the pesticides do not kill them. This can happen when too many pesticides are used in a community. Over time, these chemicals no longer are effective on mosquitoes. In addition, pesticides can be very expensive for many communities.

These are all things we must consider when making decisions about using pesticides or not. Communities must consider all options before making decisions about how to effectively create a plan.
Using biological controls involves introducing other live organisms into the community to control the mosquitoes. These organisms will help control mosquitoes in many different ways. For example, some fish and copepods eat mosquito larvae. These organisms can be put into water storage containers or wells. They will eat the larvae before they can become adult mosquitoes.

However, introduced of these organisms must be done regularly to maintain effectiveness. There is also concern of introducing organisms that are not native into the local water habitats. If non-native organisms are used there is a risk these organisms could possibly cause other local problems. Using local, native organisms is preferred. Conducting research to understand the possible local effects will help communities make decisions about what to do.

Another biological control introduces modified mosquitoes into the community. One kind of mosquito is genetically modified. In a research lab, a gene is inserted into the mosquitoes. These genetically modified mosquitoes are then released into the community. The modified mosquitoes then mate with local, wild mosquitoes. The offspring of these two mosquitoes will also have the gene from the lab. This gene will cause the offspring to die before becoming adults. This will potentially reduce the mosquito population in that place.

Another version of biological control is mosquitoes modified with bacteria. Wolbachia is a natural bacteria found in up to 60 percent of insect species. This bacteria can affect disease transmission in mosquitoes. The bacteria does not kill the mosquito. It only reduces the chance that disease will be transmitted between people.

However, it is not commonly found in some of types of mosquitoes that cause problems for humans, like Aedes. In a lab, the Wolbachia bacteria is put into Aedes mosquitoes. These mosquitoes are then released into the wild. The lab mosquitoes mate with the wild mosquitoes and pass the bacteria on to the next generation. Over time, the number of mosquitoes with Wolbachia in them grows. These mosquitoes with Wolbachia are less able to transmit diseases to people.

However, we do not completely understand the possible effects of these biologically modified mosquitoes on the whole environment of a place. Releasing them into the wild could possibly cause other problems that we do not know.

Consider all of the arguments for and against a method when making decisions about what to do.