



## PART SIX. MANAGEMENT TASK LIST

This is the list of tasks for Part Six. Management  
Check them off as you complete them.

### TASKS

- 6-1  Understanding Management Options
- 6-2  Developing Integrated Management Plans
- 6-3  Creating Local Integrated Management Plan
- 6-4  Analyzing Community Surveys (Management)
- 6-5  Debriefing Management

In this part, the team will focus on exploring a diversity of ways to manage mosquitoes. The team will then begin to develop integrated management plans for the local community concerning mosquitoes and mosquito-borne diseases.



# 6-1 Understanding Management Options

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.



## 6-1

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!*



## 6-2

# Developing Integrated Management Plans

In Task 6-1, the team learned about different management options. These are all things a community can do to manage mosquitoes and mosquito-borne diseases. However, every location is different. 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 multiple methods helps to address all of the different perspectives of the problem (social, economic, environmental, ethical). A plan that combines many different methods is called an integrated management plan.

## Objective

In this task, the team will practice making integrated management plans. The team will be provided a variety of city scenarios and budgets (which we'll express in wealth units). From these scenarios and budgets, groups will make suggestions for how each city 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 6-2 folder and get the Meet the Team reading and the list of city scenarios and management options. There is only one version of this task, but there are many ways to customize it. Think about how you could break up the reading or scenarios, if needed.
2. As a team, read the Meet the Team reading.
3. From the reading, make a list of important things to consider when making a mosquito management plan.
4. Read through each city scenario and the list of management options.



6-2

5. Note the wealth units each management option costs and how many each city has in its budget.
6. Using the information in the scenario and the budget (wealth units), create a suggested integrated management plan from the list of options. Remember to add up the wealth units for each method. You cannot have a plan with more wealth units than the budget allows.
7. Consider how your plan will address all perspectives of the problem (social, economic, ethical, environmental).
8. As a team, discuss the following:
  - Share and discuss your integrated management plan for each city scenario.
  - Provide the reasoning for why you selected those methods for each city. Compare and contrast plans from different groups.
  - Identify and share how your plan addresses each perspective of the problem (social, economic, ethical, environmental).
  - Based on your plans, how could this information be useful when thinking about creating an integrated management plan for your community?
  - How could this information be useful when thinking about the problem question: **How can we ensure health for all from mosquito-borne diseases?**

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



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!*



## 6-4

# Analyzing Community Surveys (Management)

In Task 2-3, the team surveyed people in your local community about mosquitoes.

## Objective

In this task, you will do the same analysis you did during Tasks 2-4 and 3-6, and 4-6, and 5-4. Now you will focus on the community survey results only for Part Six: Management. The team will analyze the other parts of the survey in future tasks, so keep the survey results in a safe place.

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 6-4 folder and get the survey analysis instructions and questions. Choose the Mosquito A or Mosquito B task from the task folder.

2. As a team, determine how to compile the community survey results for Part Six from all team members. You will want to analyze the compiled data from the entire team. Develop your own method for compiling the data for Part Six, 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 the graphs and data to answer these questions:

5. What interesting patterns do you see in the data from Part Six questions?

6. Which questions did most people in the community agree on?

7. Which questions did people in the community have different responses to?



### 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.





6-4

8. 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?*
9. 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?*
10. 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?*
11. Select one or two survey questions, write a claim, and provide the supporting evidence for the claim based on the question and evidence collected

Examples:

- Social media and newspapers are good methods to get mosquito information to community members.
  - Many local residents are currently not taking any individual or household action to protect themselves from mosquito-borne diseases.
12. Explain how the data evidence from the community survey supports your claims.
  13. As a team, share some claims you created and the evidence that supports that claim.

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Hooray! You completed Task 6-4. Check it off the task list. *Go to Task 6-5!*

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6-5

# Debriefing Management


This is the last task of Part Six: Management.

## Objective

In this task, we will debrief Part Six: Management. This is good to do before we move on to the next part. The objective is to think about and discuss helpful information that was gathered during this part.

1. Remember the 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.
2. Remember to use your meaningful conversation starters as needed throughout this discussion.
  - 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 ...
3. Remember when you are making claims from evidence to use the following sentences.
  - I think this claim is best supported because ...
  - I do not think this claim is best supported because ...
  - I think this piece of evidence supports this claim because ...
  - I do not think this piece of evidence supports this claim because ...

6-5

4. Go to the Task 6-5 folder to get Debriefing Transmission instructions. There is only one version of the debrief. 
5. Follow the instructions in the task folder to complete the five sections of the debrief.
- Question Map Analysis
  - Community Partners
  - Perspectives
  - Identity
  - Problem Question

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Hooray! You completed Task 6-5 and Part 6. Check it off the task list.

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Congratulations! You have completed Part Six of your research. Give yourself a pat on the back.

You now know more about different ways mosquitoes can be managed. You have also created some plans for how your local community can address this problem. Keep these plans for the next and final part.

The next part of your research will focus on putting together your final project. This final project will include your integrated management plans, along with a communication plan and a presentation to team and community members.

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Continue to Part 7: Action Plan

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Notes:

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**Mosquito! Task 6-1 Understanding Management Options**

What are different options for managing mosquitoes?

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

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.



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

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 trap 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.



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

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 mosquitos 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?



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

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.





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

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.



## Kelly Bennett - Biologist - Smithsonian Tropical Research Institute

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.



## Task 6-2 Developing Integrated Management Plans

### City Scenarios

#### City One Scenario

Our city currently has a large mosquito problem. Many people in all parts of the city are getting sick from mosquito-borne diseases each year. The city is near the equator, so it is warm throughout the year. The city has only two seasons during the year. One season is very wet and one is very dry. Also, the majority of the residents in our city have religious beliefs that do not promote killing animals. This religion teaches that any wrong behavior to animals will be paid for in a future life, so cruel acts to animals should be avoided. This includes mosquitoes. As the city government, we would like to reduce the number of people getting sick in our city. Can you develop a management plan for our city that does not include killing mosquitoes at any stage of their life? We are also interested in helping people learn more about managing mosquitoes. This will help us create an integrated management plan that respects the local culture while working toward a solution that will help everyone. Our city has 80 wealth units to spend on this project. Thank you for the help developing a suggested integrated management plan!

#### City Two Scenario

Our city has a large mosquito population but we are not currently dealing with any mosquito-borne diseases. The city also has big changes in temperature throughout the year. It gets very cold in the winter and very hot in the summer. Mosquitoes are only out during the summer. Recently, cities near us have reported new cases of mosquito-borne diseases in their communities. We are concerned that these diseases will move into our city in the future. Can you suggest an integrated management plan to help prevent mosquito-borne diseases from moving into our city? We have 60 wealth units to spend on this project. Thank you for the help developing a suggested integrated management plan!

#### City Three Scenario

Our city has a large mosquito population. Areas of high poverty are currently experiencing high numbers of people with mosquito-borne diseases. Outside of these areas of poverty there are a small number of cases. In addition, since the climate in our city is warm all year, mosquitoes are always a problem. Many residents who live outside the areas that are experiencing the problem are very opposed to the use of chemicals (larvicides and adulticides) to reduce mosquitoes in any part of the city. They think these chemicals are harmful to people, drinking water, and the environment of the entire city. We are concerned about the diseases continuing to effect these areas of poverty in our city, but we are also interested in making people in other parts of the city happy. Can you suggest an integrated management plan for our city that addresses these concerns? We have 75 wealth units to spend on this project. Thank you for the help developing a suggested integrated management plan!





### City Four Scenario

Our city currently has many mosquito management strategies in place. However, the local government has informed us that the budget for mosquito management will be decreasing next year from 75 wealth units down to 45. The reason for this decrease is that we currently do not have a mosquito problem. Mosquitoes are also very seasonal here. This means they are only out at certain times of the year. The local government wants to spend the money on other things. In a recent vote, 60 percent of the local people said they are not concerned about mosquitoes. Since 40 percent of the local people are still concerned about mosquitoes, we still want to have a management plan in place. Can you help us develop an integrated plan for our city that only uses 45 wealth units? Thanks!

### City Five Scenario

Our city is currently experiencing very high levels of mosquito-borne diseases in all parts of the city. Malaria is the primary disease affecting our city. Due to the warm weather part of the year and the wet climate the rest of the year, we need to monitor the problem all the time. The city is very poor in terms of money, so we have not had management plans in place before. However, the city recently received money from the government and other humanitarian programs from around the world to help us deal with the problem. A majority of the people in the city are in extreme poverty with low levels of education. We are concerned the public will not understand why they all need to help. We currently do not have any mosquito controls in place. Can you help us develop an integrated management plan? We now have 100 wealth units to spend on this work.

### City Six Scenario

Our city is on a small island with no mosquito vector populations currently, due to successful eradication campaigns in the past. Many people visit the island as tourists, and some come from places where mosquito-borne diseases are common. The government recently built several major seaports across the country to begin importing manufactured goods such as used tires, water storage basins, and disposable plastic containers. The island is located near the equator, so it is warm throughout the year and has one very wet and one is very dry season. As the community, we would like to reduce the potential introduction of mosquito vector populations on the island and therefore reduce the likelihood of people getting sick with mosquito-borne diseases. Can you suggest an integrated management plan to help prevent mosquito-borne diseases from moving into our country? We have 65 wealth units to spend on this project. Thank you for the help developing a suggested integrated management plan!





## 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*



## Mosquito! Task 6-2 Developing Integrated Management Plans

What things should people consider when making an integrated management plan?

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



All mosquito problems are local problems. This is because each location and population of mosquitoes is different. Mosquito behavior varies greatly across the globe. So it is important to learn about the mosquitoes living in your local area when developing an integrated management plan. Knowing what species are present is the first step in managing mosquitoes. So collecting mosquitoes is a good starting point. Then you can identify the vectors of disease and compile what is known about each. Common questions about the mosquitoes should include, what type of habitat will they use to lay eggs? Does this mosquito prefer to bite humans or will it feed on other animals as well? When this species does take a blood meal, does it prefer to bite inside or outside, at dusk or the middle of the night? Our motto here at WRBU is, ‘Know the vector, know the threat.’ This means that to fully understand the problem and develop a solution, we need to know exactly what we are dealing with. Then we can make a plan using this information.

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



We are lucky to have some solid evidence on what types of solutions work against different mosquitoes and diseases. However, integrated management plans need to be adapted to the local context. Some things to consider are mosquito behavior as well as human behavior, and the social and ethical factors that influence people’s exposure to potentially infectious bites. Some solutions will not work if they have requirements for things like roads or are only effective in certain types of water. You must think about whether the methods will work in that location. Will they be acceptable to the people living there and be cost-effective? With limited resources and money, we always need to make sure they are being applied to have the maximum impact on reducing disease and saving lives.



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

Solutions are not one size fits all when making an integrated management and action plan. This is why it is necessary to understand the kinds of mosquitoes and where they are found in a community. This environmental and social knowledge enables each community to develop a targeting approach for their unique situation.



**Kelly Bennett - Biologist - Smithsonian Tropical  
Research Institute**

Whether solutions to a mosquito-borne problem works in one location over another depends on many different things. This is because of the specific differences of the mosquitoes and people in that area. Therefore, any integrated management plan to control mosquitoes needs to be modified to address the local differences. Different mosquito populations around the world can have different behaviors. In many places they adapt to their local environments. Depending on the plan, such factors must be considered for success. Furthermore, the opinions of different cultures toward particular control methods should be considered. Getting the support of the local communities will be required for any plan to succeed.



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

The same integrated management plans for mosquito - related problems do not work in every location around the world. Here in the United States, for example, we are very fortunate to have sanitation programs and access to clean water. However, there are communities around the world that lack proper sanitation, access to safe drinking water and a wastewater system. As a result, drinking water may be left sitting in buckets or containers. So measures to address those situations may be different than what is being done in another place. Creating an integrated management plan with diversity may help it be more successful.





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

There is no silver bullet or single solution that will halt all mosquito-borne diseases. This is why making an integrated management and action plan is needed. Vaccines for diseases are excellent, but expensive and slow to develop. Sterile insects are safe and effective, but to date difficult to deploy efficiently

with mosquitoes. Chemical control is efficient, but expensive and time consuming, not to mention unsustainable. Habitat removal is extremely useful and the most basic, but the most costly initially and difficult to maintain. Community action can reduce larval mosquito habitats, but it's difficult to coordinate. Therefore, no single solution can address mosquito problems in a single location, let alone the limitless variety of communities. All solutions are tools that can be used to solve the problem of mosquito control and all tools have their purpose. Similarly, a carpenter cannot build a house with only a hammer. The carpenter needs many tools and possibly special tools to work in a variety of locations, such as a city, the suburbs, or out in the country. However, a carpenter must be smart and adaptable to build in some conditions. Therefore, if given the knowledge and materials, the carpenter can undoubtedly make or achieve what is needed to construct any house in any situation. Mosquito control is a similar situation, where one tool is not sufficient for all situations. Hopefully, individuals can introduce or create other tools needed for the local community and situation to best address mosquito-borne diseases.



### 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)

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## **Task 6-4 Analyzing Community Surveys (Management)—Mosquito A**

### **Compiling Survey Data Options**

First we must compile the answers from every person on the team to all of the questions from Part Six: Management. The team will look at the other parts in other tasks.

Here are some options for compiling the answers to the survey questions in Part Six. But, as always, if you have different methods 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?

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—Mosquito A

Use this survey to compile data.

### 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.		

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## **Task 6-4 Analyzing Community Surveys (Management)—Mosquito B**

### **Compiling Survey Data Options**

First we must compile the answers from every person on the team to all of the questions from Part Six: Management. The team will look at the other parts in other tasks.

Here are some options for compiling the answers to the survey questions in Part Six. But, as always, if you have different methods 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?

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—Mosquito B. Use this survey to compile data.**

**Part 6: Management**

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

<b>Which source do you most trust for accurate information about mosquito-borne diseases?</b>				
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

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## **Task 6-5 Management Debrief**

### **Question Map Analysis**

1. Look at your team question map from Task 1-10. Are there any questions on your map that were addressed in Part Six: Management?
2. What evidence did you collect during Part Six that could be useful to answer any questions on your question map?
3. How could this evidence or information be useful to develop a solution to the problem question: How can we ensure health for all from mosquitoes?
4. Take time to rearrange, update, or modify any questions on your question map at this time.

### **Community Partners**

1. As a team, look over the list of community partners you created in Task 2-5.
2. As a team, decide if there are any community partners you could contact to get more information about these research questions you identified on your question map from Task 1-10.
  - Make a plan as a team to communicate with these partners
  - Create a list of questions you would like to ask the partners
  - Email, phone, or write to each partner with your questions.
  - If the team decides it's appropriate, invite the community partner to meet with the team. Use your list of questions to have a conversation with them.

### **Perspectives—Four Corners Strategy**

1. Label four corners of the room with the following signs: Social, Economic, Environmental, Ethical. If you do not have corners, just mark four different areas in the room.
2. Four different statements will be read to the team, one at a time.

#### Statements

- People in our local community should be more involved and work together to monitor and share information about mosquitoes and their habitats.
- It is okay to release genetically modified mosquitoes into the community.
- Changes in the local climate should be better monitored.
- When spending money on local development, builders and governments should think about the possible effect buildings could have on mosquitoes, habitats, and mosquito-borne diseases.





3. After each statement is read, take a minute and let each team member think about which category they think this statement best belongs in: Social, Economic, Environmental, or Ethical.
4. You can write down your answers and reasons for your choice, if you would like.
5. All team members should move to the corner that corresponds to their choice.
6. Move to a whole team discussion.
  - Remember, team members must back up opinions with information and other team members must listen carefully to one another.
  - Can individual team members explain to the team the reasons for their position at that corner?
  - How many team members changed their positions after hearing people talk during the whole team discussion?
  - What led you to change your mind?

### **Identity**

- Look at your personal and team identity maps from Tasks 1-1 and 1-4. What aspects of your or your teams Identity might influence your opinions on the perspectives?
- How might your decisions be influenced by these parts of your identity?
- Have any parts of your identity map changed?

### **Problem Question**

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

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