Mosquito!

Using NASA Citizen Science to bring Global Goals to Local Learning and Action

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INSTITUTE *for* **GLOBAL ENVIRONMENTAL STRATEGIES**

Smithsonian Science Education Center

Mosquito! Curriculum

In June 2018 the Smithsonian Science Education Center (SSEC), in collaboration with the InterAcademy Partnership (IAP), released *Mosquito! Community Research Guide*, a freely available international module for elementary-secondary schools that uses the United Nations Sustainable Development Goals (SDGs) as a framework for actions that are student-defined and implemented. *Mosquito!* is the first module released by the Smithsonian Science for Global Goals project. The series is designed to be region- and grade level-agnostic, provide an opportunity to learn first-hand from researchers, engage students in inquiry-based experiences in their local community, and present problems through multiple perspectives - social, ethical, economic, and environmental.

The Institute for Global Environmental Strategies (IGES) partnered with SSEC to incorporate NASA GLOBE Observer Mosquito Habitat Mapper (GO MHM) citizen science into the Mosquito module. This work was done under IGES's NASA Science Activation award - the NASA Earth Science Education Collaborative (NESEC). NESEC is a partnership between IGES and the Earth science divisions at three NASA Centers: Goddard, Langley, and Jet Propulsion Laboratory. NESEC's mission is to develop and provide authentic, meaningful and engaging STEM experiences, based on NASA Earth science, that are delivered to diverse learners through strategic partnerships.

This innovative partnership between IGES and SSEC is enabling NASA Earth science to be incorporated into a broader ecosystem of educational modules, thus ensuring sustainability, and engaging young people to develop STEM identities.

SUSTAINABLE DEVELOPMENT GOALS

The United Nations Sustainable Development Goals (SDGs) provide a framework for the Smithsonian Science for Global Goals Community Research Guides - based on sustainable actions that are student-defined and implemented.

The first community research guide – *Mosquito!* – focuses on the overarching question "How can we ensure health for all from mosquito-borne disease?" and aligns with UN SDG 3: Good Health and Well-Being: Ensuring healthy lives and promoting the well-being for all at all ages is essential to sustainable development.

Smithsonian SCIENCE *for Global Goals*

MOSQUITO! COMMUNITY RESEARCH GUIDE

HOW CAN WE ENSURE HEALTH FOR ALL FROM MOSQUITO-BORNE DISEASES?

Key characteristics of this model curriculum:

- Provides region and grade level-agnostic approach: teachers across the world teaching students from ages 8-17 will be able to engage in this material.
- Includes field tests and reviews by subject matter experts, teachers, and students. The module was field tested internationally at nine sites, including schools in the U.S. (Reston, VA and Leominster, MA), Australia (Perth, Melbourne, Fremantle, and Apollo Bay) and Indonesia (West Java, SMP Irsyaadul Ibaad, and SDN Karangpawulang).
- Provides an opportunity to learn first-hand from researchers working on the problem from around the world through numerous readings.
- Engages students in inquiry-based experiences in their local community.
- Integrates disciplines: science, social studies, and civics/citizenship.
- Presents problems through multiple perspectives (social, ethical, economic, environmental).
- Built on a rich storyline that begins with students creating an *Identity Map* and *Defining the Problem* and ends with the development of an *Action Plan*.

Learning Progression:

The instructional design for the community research guides combines key pieces of inquiry-based science education and social studies education. This progression takes students from questioning and investigating up through taking action in their own communities.

The center portion of the progression – *Critical Reasoning* and *Systemic Understanding* – is the tie that binds. Armed with their new scientific understanding of the complex issue, this is where students examine their own values and perspectives on the issue, how these influence their local and global thinking, and finally they see how their perspective changes as they learn more and more about the world around them.

(Image: ©2018 Smithsonian Institution: Heidi Gibson, Katherine Blanchard, Andre Radloff, Brian Mandell)

Learning teams use their understanding to find common ground, build consensus, and plan and carry out local actions for Global Goals.

Implementation:

Locations that have already implemented the *Mosquito!* module and/or engaged in professional development include Australia, Indonesia, Malawi, Panama, and the United States.

(Photo Courtesy of Luc Deschamps, Jacaranda Foundation, Malawi)
Students at the Jacaranda school in Malawi begin to engage with the question, "How can we ensure health for all from mosquito-borne diseases?"

(Photo Courtesy of Jorge Alemán, Smithsonian Tropical Research Institute)
Teachers attending an SSEC Mosquito education professional development workshop in Panama City, Panama learned how to implement the curriculum, including using the GLOBE Observer Mosquito Habitat Mapper.

Storyline for *Mosquito! Community Research Guide* has seven customizable parts.

Part 1: Problem
In this part, the team will begin defining the research problem and setting up your local research plans. To do this the team will need to learn more about the team members, different perspectives, and questions you will work to answer during your research.

Part 2: Community
In this part, the team will focus on what the local community thinks about what the local community likes about mosquitoes. The team will also establish their research sites and begin identifying local partners they could potentially work with throughout their research.

Part 3: Life
In this part, the team will focus on learning about the life of the mosquito. Research will include collecting and comparing mosquitoes within research sites while studying the life cycle and global distribution of different mosquitoes.

Part 4: Transmission
In this part, the team will focus on understanding factors that affect how mosquito-borne diseases are transmitted. Research includes identifying potential host animals, local histories, and changes in the local environment that could affect how diseases may be transmitted through your research site now and in the future.

Part 5: Habitats
In this part, the team will focus on researching where mosquitoes live and breed in the community. Research of man-made and natural habitats will be conducted.

Part 6: 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.

Part 7: Action Plan
In this part, the team will focus on developing a local community action plan. This plan will outline the research that was conducted, the actions the team thinks people need to take in the community, and a communication plan to share the plan with local community members.

Readings introduce students to scientists and how they handle complex issues that students will also encounter in different parts of the project. For example, in Part 1 students create Identity Maps, which they can then compare with the Identity Maps of scientists. This introductory activity helps students see scientists as diverse people, who may share common interests and backgrounds with them.

Other readings connect to questions students will encounter in other parts of the curriculum. For example, Why is it important to look at the mosquito problem from different perspectives? What do you do when people on your project don't agree? Tell us about a time when a research project did not work out as planned?

Smithsonian SCIENCE *for Global Goals* | **Meet the Team**

Mosquito! Task 1-6 Defining the Problem

RUSTY LOW

SENIOR EARTH SCIENTIST

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!

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

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

ETHICAL

ECONOMIC

SOCIAL

ENVIRONMENTAL

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

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

Smithsonian SCIENCE *for Global Goals* | **Meet the Team**

Mosquito! Task 1-8 Exploring Research Perspectives

What do you do when the team does not agree?

David Pecor - Walter Reed Biosystematics Unit (WRBU)

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

Russane Low - Institute for Global Environmental Strategies

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PART FIVE. HABITATS TASK LIST

This is the list of tasks for Part Five. Habitats
Check them off as you complete them.

TASKS
- 5-1 Understanding Mosquito Habitats
- 5-2 Identifying + Mapping Local Habitats
- 5-3 Surveying Local Vegetation Habitats
- 5-4 Analyzing Community Surveys (Habitats)
- 5-5 Debriefing Habitats

In this part, the team will focus on researching where mosquitoes live and breed in the community. Research of man-made and natural habitats will be conducted.

5-1   Understanding Mosquito Habitats

Welcome to Part Five: Habitats, and Task 5-1. In Part Four you learned more about how the mosquito spreads disease. Now, the team will begin learning more about the specifics of where mosquitoes like to live and breed in your community.

Objective

In this task, the team will be focusing on the following question from the question map.
- Where do mosquitoes live and breed?

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 below. 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?

Zika Zapp Bingo

Partnering with GLOBE Observer

GLOBE Observer

Choose your protocol:
- clouds
- mosquito habitat mapper
- Land Cover · Adopt a Pixel

Visit the Observer Website

NASA's *GLOBE Observer* app currently includes three tools for citizen scientists: *Clouds, Mosquito Habitat Mapper,* and *Land Cover.* In 2019, two additional tools will be added: *Tree Height* and *Fire Fuels.* Using the *Mosquito Habitat Mapper* tool, students are able to take and submit observations of their local environment. See the step-by-step guide below showing what students are able to do using the app. Participants can elect to do one or more of the steps.

Safety First!
The up-close observations when using the Mosquito Habitat Mapper focus on mosquito larvae - an immature developmental stage that lives in water, does not bite, and does not pose a health hazard to humans.

The mobile app and educational materials include a safety warning for citizen scientists to protect themselves from mosquito bites. These include wearing a long-sleeved shirt and long pants and applying an approved insect repellent (containing DEET) to skin and clothing as directed on the product label.

Observers should also minimize exposure time by collecting samples and returning indoors to analyze the samples.

Use this QR Code to download the mobile app.

GLOBE Observer Mosquito Habit Mapper is a field component for Part 5 of the curriculum, when students focus on the questions:
Where do mosquitoes live and breed, and what influences this?

Using the app, students locate and photograph potential mosquito breeding sites; sample and count mosquito larvae that are present; identify whether the larvae are types that potentially are vectors of disease (using a clip-on microscope and in-app dichotomous key) and eliminate water sources where mosquitoes may breed. Students upload their observations to the GLOBE database, which is freely accessible.

Each part of the curriculum starts with a *Management Task List*, which students complete. Tasks are clearly outlined with questions to focus student discussion and activities - see sample pages from the curriculum for part for tasks 5.1 and 5.2, which incorporate the *GLOBE Observer Mosquito Habitat Mapper*, and educational game, *Zika Zapp Bingo*. This game helps students understand the range of habitats where they may find mosquito larvae. Each section is supplemented with readings that introduce them to a range of scientists working on issues related to mosquito-borne disease.

Other student tasks in Part 5 include analyzing the results of a community survey conducted by students in Part 2 (the survey is broken into sections that align with the different part of the curriculum) and debriefing at the end.

GLOBE mosquito habitat mapper
A Step-by-Step Guide

1. **Locate Potential Mosquito Habitats**
2. **Sample and Count**
3. **Identify Larva Type**
4. **Eliminate the Habitat**

Award Winning Curriculum:

2018 Smithsonian Education Innovation Award

On November 2, 2018, the Secretary of the Smithsonian Institution, David Skorton, announced that Smithsonian Science for Global Goals received the Smithsonian Education Innovation Award for its "boundary-pushing approach to helping students across the globe understand critical socio-scientific issues and how they can take action in their local communities to make a difference."

For More Information:

Smithsonian Science for Global Goals
https://ssec.si.edu/global-goals
Mosquito! Community Research Guide
https://ssec.si.edu/mosquito
GLOBE Observer Mosquito Habitat Mapper
https://observer.globe.gov/

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