

# Improve Your World

## Description

This lesson is an introduction to the NC State University *ASSIST Center One Health Challenge*. Use the following information to guide students on an exploration of the One Health mission and discuss how all organisms are interconnected. Students will define worldwide health issues, list global health problems and ask an expert how they can potentially solve these global health problems.

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## Introduction

Since the 1800s, scientists have noted the similarity in diseases among animals and humans, but human and animal medicine were practiced separately until the 20th century. In recent years, the concept of One Health between animals and humans has gained more recognition in the public health and animal health communities. (<https://www.cdc.gov/onehealth/people-events.html>)

This lesson introduces the statewide One Health Challenge to students. The One Health Challenge is a competition hosted by NC State University's ASSIST (Advanced Self-Powered Systems of Integrated Sensors and Technologies) Center. In the competition, students create, build and present their own wearable devices to combat a One Health related issue.

Over two 60 minute class periods, students explore zoonotic diseases through internet research, YouTube videos and class discussion. To evaluate student understanding of the new material, students are assessed through a group mind mapping final product on different global health challenges. The mind map is then presented to the entire class. After this lesson is complete, student groups are prepared to use the engineer design process (EDP) to start imagining, planning and creating their One Health Challenge project. [The subsequent EDP lesson is linked here.](#)

## Curriculum Alignment

### **North Carolina Department of Public Instruction Essential Standards:**

#### **5.L.2 Understand the interdependence of plants and animals with their ecosystem. (Grade 5)**

- 5.L.2.1 Compare the characteristics of several common ecosystems, including estuaries and salt marshes, oceans, lakes and ponds, forests, and grasslands.
- 5.L.2.2 Classify the organisms within an ecosystem according to the function they serve: producers, consumers, or decomposers (biotic factors).
- 5.L.2.3 Infer the effects that may result from the interconnected relationship of plants and animals to their ecosystem.

#### **6.L.2 Understand the flow of energy through ecosystems and the responses of populations to the biotic and abiotic factors in their environment. (Grade 6)**

- 6.L.2.1 Summarize how energy derived from the sun is used by plants to produce sugars (photosynthesis) and is transferred within a food chain or food web (terrestrial and aquatic) from producers to consumers to decomposers.
- 6.L.2.2 Explain how plants respond to external stimuli (including dormancy and forms of tropism) to enhance survival in an environment.
- 6.L.2.3 Summarize how the abiotic factors (such as temperature, water, sunlight, and soil quality) of biomes (freshwater, marine, forest, grasslands, desert, Tundra) affect the ability of organisms to grow, survive and/or create their own food through photosynthesis.

**5.TT.1** Use technology tools and skills to reinforce and extend classroom concepts and activities.

**5.RP.1** Apply a research process as part of collaborative research. (Grade 5)

**6.TT.1** Use technology and other resources to access, organize, and share information.

**6.RP.1** Apply a research process for collaborative or individual research. (Grade 6)

### **Next Generation Science Standards:**

#### **MS-ETS1-1.**

Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

#### **MS-ETS1-2.**

Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

#### **MS-ETS1-3.**

Analyze data to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

## Objectives

- Students will define zoonotic disease
- Students will identify at least 3 zoonotic diseases
- Students will explain how zoonotic disease impact entire ecosystems
- Students will summarize the mission of One Health and the One Health Challenge
- Students will collect information about different global health issues
- Students will create a mind map to teach the class about the global health issues their group is most interested in solving through the One Health Challenge

## Time & Location

This lesson takes place in a classroom or indoor area with internet access to show short videos. The lesson can be completed within two 60 minute class periods.

## Teacher Materials

- Projector or TV
- Computer
- Speakers (may be needed depending upon computer and projector connection)
- 1 copy of classwork with 3 website research questions for each student (addendum 1)
- 1 copy of mind map and presentation rubric for each group
- 1 piece of 25" x 30" chart paper for each group
- Colored markers for each group to use on mind map

## Student Materials

- Pencil
- 1 copy classwork per student of handout (addendum 1)

## Safety

Adopted from *Science and Safety: It's Elementary!* Safety manual produced by the Council of State Science Supervisors (CSSS).

- Keep spaces where science activities are conducted uncluttered.
- Limit size of student working groups to a number that can safely perform the activity without causing confusion and accidents.
- Provide adequate workspace (45 square feet) per student as well as low table sections for wheelchair accessibility that can be supervised by recommended ratio of teacher to student of 1:24.
- Do not permit eating and drinking in any space where science investigations are conducted.
- Do not store, under any circumstances, chemicals and biological specimens in the same refrigerator used for food and beverages.

## Student Prior Knowledge

Students should be familiar with the Ecosystems section of the North Carolina Department of Public Instruction Essential Standards for 5th grade science. (5.L.2 Understand the interdependence of plants and animals with their ecosystem) While this lesson can serve as an extension activity or performance task for

5th or 6th grade students, it should be taught in sequence after the critical vocabulary (listed below) has been introduced and spiraled into subsequent activities.

## Teacher Preparations

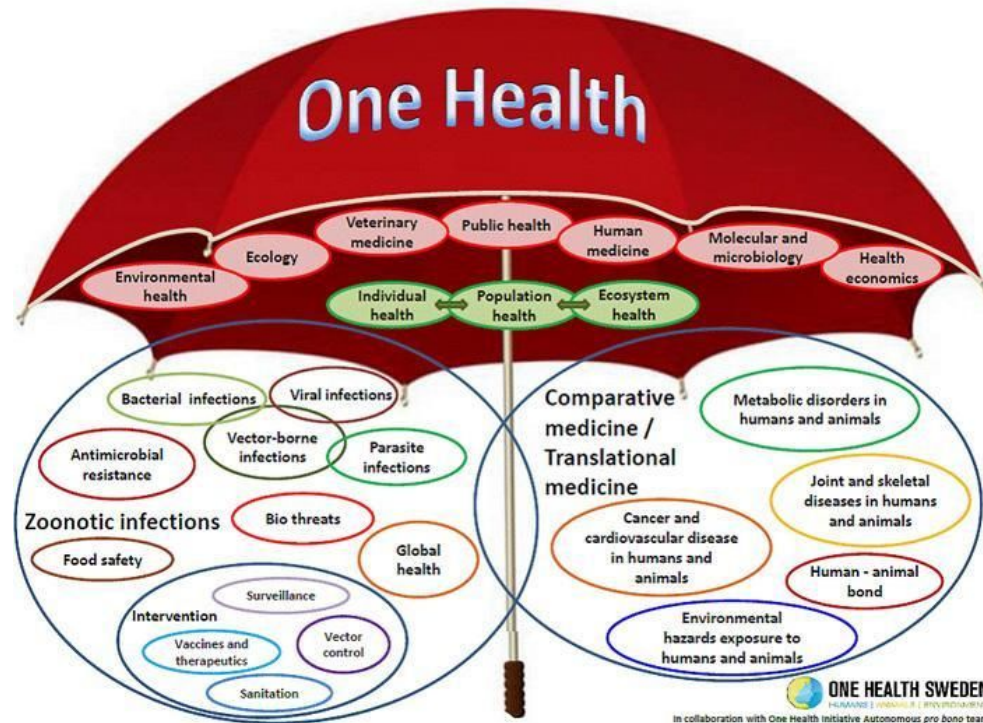
- On computer or classroom TV, set up [One Health intro video](#)
- Make copy of mind map and presentation rubric for each group
- Make copy of classwork for each student
- Students should have individual internet access or work in partner groups to research online
- Separate chart paper and colored markers so each group has 1 piece of chart paper and at least 3 colored markers

## Activities

### Day 1:

- o **Engage with a Hook:** (10 min) Teacher will introduce the One Health Challenge to class.
  - o Teacher will say, “One Health is a worldwide movement to study the relationships between, humans, animals and the environment we all live in together. As you know, every organism in an ecosystem or environment is interconnected, so if one organism gets sick or experiences a population increase or population decrease, all organisms are affected.
  - o This year we will compete against students from across the state in a competition through NC State University called the ONE HEALTH CHALLENGE! In small groups, we will create projects to solve global health problems. But wait... what are global health problems? Before we dig into this question, let’s watch a quick video to gain more background knowledge about One Health.”
  - o Teacher will show [One Health intro video](#) to students, prep students so they know the teacher will stop video at specific points throughout the video to ask questions.
  - o As the video plays, Teacher will stop the video at the following points to check for understanding:
    1. Stop video after 30 seconds (00:30). Teacher will say, “what did the video mean when it said at the beginning, a healthy individual doesn’t exist in isolation?”
      - o Teacher will use wait time to encourage students to think through their answer. Students can then share their answer with a partner or 3-4 students can share their thoughts full group.
      - o Teacher will guide students to the answer of organisms in an ecosystem are **interconnected**, no individual organism lives alone.
      - o To make question vocabulary accessible, teacher may need to breakdown question by asking class the definition of isolation (alone) and exist (live).
    2. Stop video after 1 min and 2 seconds (01:02) Teacher will say, “what are some examples of humans living with or near different animals?”
      - o Students should bring up examples of pets, livestock and wildlife.
    3. Stop video at 1 min and 16 seconds (01:16) Teacher will say, “What are SARS, MERS Virus and H1N1 flu?”
      - o Teacher will guide students toward answer that all 3 are examples of bacteria and viruses passed from animals to people.
    4. Follow up question, “how has increased global travel made these viruses and bacteria more dangerous to people?”

- o Teacher will guide students toward understanding how greater global travel allows spread of these viruses and bacteria to more places than ever before, often before the person or animal has been diagnosed or treated. This is what the video means when it says “gives previously isolated outbreaks pandemic potential.” Zoonotic diseases now have a greater potential to hurt lots of people and animals around the world.
- o Teacher will project One Health diagram below for whole class.



- o Teacher will say, “In summary, One Health is like an umbrella, working to protect the health of individuals, populations and ecosystems in two specific ways. The first is comparative and translational medicine. This includes, research on cancer and disease that affects humans and animals. It also includes the creation of policies to stop the exposure of people and animals to pollution, hazardous material and ecological disasters. The second way One Health works to protect humans and animals is from the spread of zoonotic diseases. In class today, we will focus on learning about zoonotic diseases”
- o **Explore New Material:** (30 min) Teacher will circulate classroom as students research One Health in detail at the [One Health website](#) and watch 3 videos for more information on zoonotic diseases.
  - o Teacher will pass out the classwork for today with the following 3 research questions and space for students to answer the questions.
  - o While students read information on the website, they should find answers to the following:
    1. How do physicians, ecologists and veterinarians at the CDC use a One Health approach to control public health threats?
      - o By learning how disease spreads among people, animals, and the environment.
    2. What is a zoonotic disease?

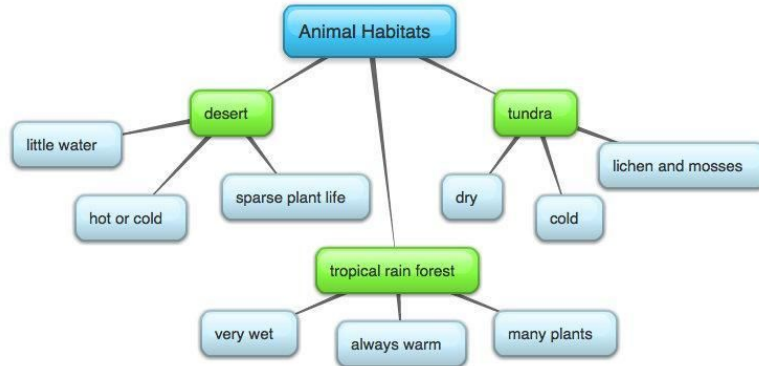
- A zoonotic disease is caused by a virus, bacteria, parasite or fungi that spreads between animals and humans.
- 3. Teacher will check to make sure students answered question #1 and #2 correctly, then release students to watch these 3 videos on zoonotic disease (listed on addendum 1 classwork):
  - Intro to different examples of zoonotic diseases:  
<https://www.youtube.com/watch?v=PSQPikvU6pc>
  - Veterinarian describes 6 zoonotic diseases we get from pets  
<https://www.youtube.com/watch?v=K4TkyMzVYyE>
  - Dr. Snow solves the riddle of Cholera  
<https://www.youtube.com/watch?v=M7CeZXJ4DgM>
- **Explain misconceptions and practice new application as a class:** (20 min) to conclude class, Teacher will bring students back together full group and use the following questions to discuss content from the 3 videos as a full group and probe for misconceptions. Teacher will push students to use scientific vocabulary correctly and speak in complete sentences.
  - **Video 1 & 2:** Your pets can carry zoonotic diseases too! What zoonotic diseases did you learn about from the veterinarian in the video? (Answers will vary, but goal is for students to share out examples of zoonotic diseases and how each disease is spread.)
  - **Video 3:** What did Dr. Snow find caused the zoonotic disease of Cholera spread in London? (Cholera spread through a bacteria in the water)
  - How can the spread of zoonotic diseases through water an important discovery for your One Health Challenge projects? (Answers will vary, but this could lead to some early brainstorming on possible projects.)

#### Day 2:

- Evaluate student understanding through assessment (60 min) Teacher will assess student knowledge on zoonotic disease as they work in groups to create mind maps to teach their peers. (see assessment section below for more information)
  - Teacher will assign students into their One Health Challenge groups. (ideally 4 students per group, max 6 students per group)
  - Teacher will provide each group with a copy of the mind map and presentation rubric. (addendum 1)
  - Teacher will have students discuss what they learned yesterday to review main concepts and spiral important information.
    - What is a zoonotic disease?
      - A zoonotic disease is caused by a virus, bacteria, parasite or fungi that spreads between animals and humans.
    - How do zoonotic diseases impact entire ecosystems?
      - Zoonotic diseases pass between animals, humans and their environment.
    - Why are zoonotic diseases more dangerous today than ever before?
      - With global travel, these dangerous diseases can be passed between organisms around the globe.
    - How does the One Health Challenge address these global health issues?
      - Our groups will identify a global health issue we want to address and create a solution to the problem.

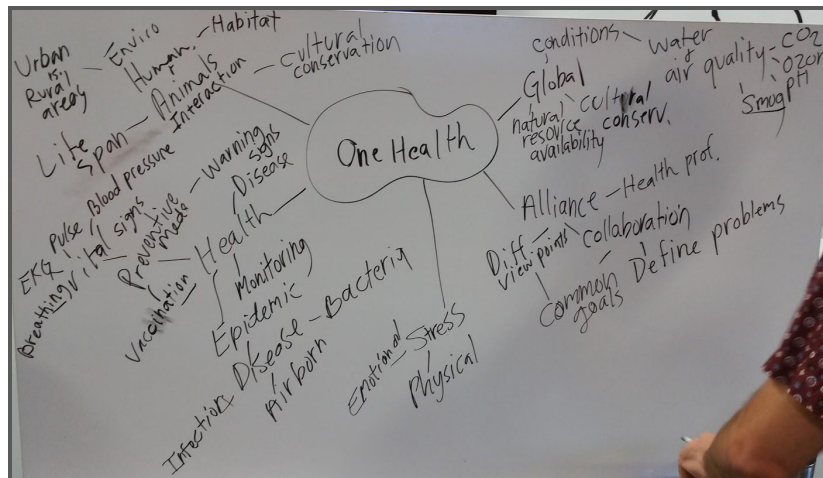


o Teacher will introduce the concept of mind mapping by projecting the example of different animal habitats below. According to [mindmapping.com](http://mindmapping.com), a mind map is a highly effective way of getting information in and out of your brain. Mind mapping is a creative and logical means of note-taking and note-making that literally "maps out" your ideas. For example, the mind map from [learnnc.org](http://learnnc.org) below is for different animal habitats:



o Teacher will provide student groups with a sheet of chart paper and a variety of colored markers.

o Student groups (4 students max. per group) will complete a mind mapping exercise on global health concerns they may want to address through their project. (Mind mapping example below)



- o For more information on mind mapping, check out <http://www.mindmapping.com/>.
  - o Student groups will then present their mind maps to the class. This will provide students with even more background knowledge and ideas on different zoonotic diseases to combat through the One Health Challenge.
    - o Teacher will distribute chart paper and colored markers to students. Mind maps should be completed on chart paper and should be written large and legible enough so class can read the map when student groups present their project to the class. While different colored markers are not a necessity, it does allow students to better organize and group their thoughts. Review the mind map example of animal habitats above for example of color coding on a mind map.
      - o Teacher will then circulate and push students to add detail to mind maps. Each student should be an “expert” on at least 3 different zoonotic diseases based on their

research from the previous class period. Students should be ready to present mind maps by end of class.

- o Elaborate or Extend: Teacher will provide students with resources to extend their research into the global health issues they are interested.
  - o Using the [global issues page on the United Nations website](#), each student can research global issues in more detail.
  - o If internet access is limited, teacher can print off a variety of the issue breakdowns provided by the UN by clicking on the desired topic using the menu on the left hand side of the screen.

## Assessment

The primary assessment for this lesson is a group-produced mind map and presentation on global health research.

- Teacher will use a rubric (see addendum 1) to score the mind map and group presentation.
- List of 1-3 global health issues.
- By completing the assessment, each group will narrow down their mind map of global health issues to a short list of 1-3 problems. Student groups will then narrow the focus of their group project to 1 global health issue in the next lesson on the Engineering Design Process.
- In subsequent lesson on the Engineering Design Process, students will decide which specific issue they want to address and how the wearable device they create will combat the problem.

## Critical Vocabulary

Ecosystem: The biotic organisms and abiotic factors in a specific area that work together

Terrestrial: An **ecosystem** found only on landforms. Six primary **terrestrial ecosystems** exist: tundra, taiga, temperate deciduous forest, tropical rain forest, grassland and desert

Aquatic: An **ecosystem** in a body of water

Food chain: Diagram showing pathway of energy flowing through producers, consumers and decomposers

Food web: Diagram showing the many different pathways energy can flow in an ecosystem

Energy pyramid: An energy pyramid is a model of energy flow in an ecosystem. The different levels represent different groups of organisms that might compose a food chain. An energy pyramid's shape shows how the amount of useful energy that enters each level decreases as it is used by the organisms

Interconnected: Everything is connected in an ecosystem. Things that effect one organism directly affects everything else indirectly

Increase: To grow or make greater in size, amount or intensity

Decrease: To shrink or make smaller in size, amount or intensity

Producer: Usually green plants or algae that use chlorophyll to convert energy from the sun into food

Consumer: Animals are consumers because they cannot make their own food, so they need to consume (eat) plants and/or animals. There are three types of consumers: carnivore, omnivore and herbivore

Decomposer: Organism such as bacteria and fungi, eat decaying matter - dead plants and animals and in the process break down and decompose them. When that happens, decomposers release nutrients and mineral salts back into the soil - which is then used by plants

Predator: An animal that hunts and eats what it kills

Prey: An animal that is hunted and eaten as food

Photosynthesis: The process by which plants use the sun to make their own food

Biotic: Any factor that is or once was alive



Abiotic: A nonliving factor in an ecosystem

Recycle: The movement of organic and inorganic matter back into the production of living matter

Nutrients: A substance that provides nourishment essential for growth and the maintenance of life

## Author Information

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Addendum 1 (Student Classwork)

Go to:

<http://www.cdc.gov/onehealth/index.html>

Use the website to answer the following questions. Be ready to discuss.

1. How do physicians, ecologists and veterinarians at the CDC use a One Health approach to control public health threats?

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2. What is a zoonotic disease?

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Learn more about different examples of zoonotic diseases on the following YouTube video:

<https://www.youtube.com/watch?v=PSQPikvU6pc>

Learn more about zoonotic diseases as a veterinarian describes 6 zoonotic diseases we get from pets:

<https://www.youtube.com/watch?v=K4TkyMzVYyE>

Learn more about zoonotic diseases as Dr. Snow solves the riddle of Cholera:

<https://www.youtube.com/watch?v=M7CeZXJ4DgM>