

Lesson Author(s)	Katelyn Carew
Lesson Title	Global Distribution of Malaria
Lesson Source	
Technology Needs (if any)	ESRI online map gallery ArcGIS map maker Worldmapper.com Projector for cholera map display
Date/Time Lesson to be Taught	
School	
Supervising Teacher	
Math or Science?	Science
Lesson Concepts	Exploring the geographic distributions and trends of disease
Objectives	Students will be able to analyze and replicate GIS layered mapping systems that draws trends and starts to answer scientific questions. Students will be able to briefly explain why malaria is more prevalent in the equator through global climate trends.
CO State Standards	Eighth grade science "Earth has a variety of climates defined by average temperature, precipitation, humidity, air pressure, and wind that have changed over time in a particular location" (or in a simpler version) Sixth grade science "Changes in environmental conditions can affect the survival of individual organisms, populations, and entire species"
Materials List and Advanced Preparation	-John Snow (old) cholera map of London http://upload.wikimedia.org/wikipedia/commons/c/c7/Snow-cholera-map.jpg -ArcGIS explorer map maker online available to students/student groups (and ArcGIS account so the students can save their work) -other mapping websites to provide comparisons for the students like worldmapper.com and ESRI online story map gallery (possibly nothingbutnets.com too)
Safety	General classroom management should be kept
Accommodations for Learners with Special Needs	

1. ENGAGEMENT		Time: Minutes 10
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Misconceptions
<p>The teacher will display on the projector an old map of cholera deaths in London and simply pose the question to the students “What can you conclude about this map? What trends do you see?” The students will write one significant observation on a small scrap of paper with their initials on it and place it in a communal bowl. The teacher will choose 1 or 2 responses from bowl at random and read them anonymously to the class and discuss the validity of the comment. (This puts responsibility on all the students without embarrassing anyone). The teacher will then introduce the importance of maps and GIS systems in finding scientific trends (especially when it comes to disease distribution). The teacher can also link this to a major disease of concern today: malaria.</p>	<p>What trends do you see on this map? What is this a map of?</p> <p>What can you conclude? What scientific conclusions can you draw?</p> <p>How can scientists use this type of data?</p>	<p>Have trouble reading the small font on the map. Reading the map more geographically than scientifically.</p>
Evaluation/Decision Point Assessment		Student Outcomes
<p>1 or 2 responses from select students read aloud in class would show where the students are at in regards to scientifically interpreting maps. Also, the teacher can read the rest of the responses after class as a form of pre-assessment.</p>		<p>At least one comment on the map</p>

2. EXPLORATION		Time: Minutes 45
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Misconceptions
<p>The class will be split up into 3 or 4 groups. Each group will be assigned the open-ended scientific question “Where is malaria most prevalent in the world? Why is this?” Their job will be to research possible answers to this question and display the results they find in a GIS layered map in ArcGIS online map maker. At this point the students should already be at least a little familiar with how to use ArcGIS. But if there is still confusion with how to display their results, the teacher will demonstrate with the question “Why are volcanos found where they are?” by overlaying a tectonic plate map with a map of all the world’s volcanos. After the groups are released, it is essential that the teacher walks around to clarify any misconceptions.</p>	<p>Where is malaria most prevalent in the world? Why is this?</p> <p>What are the climates like in these areas?</p> <p>What organisms (some that may carry disease--mosquitos) live in these types of climates?</p> <p>Is there a social aspect too to this question? What is the poverty level in the areas of high concentration of Malaria?</p> <p>What about the south of the US? They have a lot of mosquitos too. Why is malaria not prevalent there? What disease is prevalent in these areas that is carried by mosquitos?</p>	<p>Students may focus too much on Africa and forget to notice other countries along the equator that also has high concentrations of Malaria.</p>
Evaluation/Decision Point Assessment		Student Outcomes
Student involvement in their groups.		Overlaid maps that can be easily interpreted.

3. EXPLANATION		Time: Minutes 30
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Misconceptions
<p>Near the end of their activity, students will be shown how to save their maps and how to display it onto the projector. The students will present their maps to the class but are limited to 5 words. The rest of the class will have to interpret the map themselves in a class discussion led by the teacher. Only afterward may the group be allowed to say whether the class's interpretation was on par with what they were trying to convey. Each group will do this. The teacher may lead a small discussion regarding the students' findings.</p>	<p>What trends do you see? What conclusions can you draw? (dependent on discussion)</p> <p>Now that you have seen the other groups' maps, what would you change about your map or your conclusion you had before the activity?</p>	<p>Someone interpreting another group map in a way that was unexpected or slightly off topic.</p>
Evaluation/Decision Point Assessment		Student Outcomes
<p>Peer interpretation assesses the validity of the groups' maps and make sure the students put thought into communicating their findings.</p>		<p>a completed readable map and a new conclusion to the question.</p>

4. ELABORATION		Time: Minutes 20
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Misconceptions
The teacher will then have the students return to their seats and show them some other maps that interpret this open question. These maps can be found at worldmapper.com (mainly) and ESRI online. The class will compare and contrast these maps to theirs. The teacher may also visit nothingbutnets.com to explore some ways the spread of malaria is being prevented.	<p>What is the difference between these maps? Which do you like better? Which is easier to read? Which is more useful in regards to scientific research? What could this map be used for other than scientific research?</p> <p>How can scientists use this data to help prevent further spread of Malaria?</p> <p>How does disease spread on a global level? Why is disease more prevalent in largely populated cities? (if discussion gets advanced).</p>	Students getting distracted with other interesting maps in the search (which is a good reason to show the class on the projector rather than have them explore themselves on the computers).
Evaluation/Decision Point Assessment		Student Outcomes
Student responses and questions in discussion		Participation

5. EVALUATION		Time: Minutes 5
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Misconceptions
<p>On the last map, the teacher will ask the students to make at least one comment or question on a small scrap paper and place it in a communal bowl much like in the engagement. This will act as a kind of post-assessment.</p> <p>What did you learn about the spread of malaria today? How can you prevent the spread of malaria?</p>		
Differentiation		Time: N/A
Students who are behind or need support	For advanced or gifted students	
Ask questions that guide them towards the goal of the open question.	Show them more advanced tools in the ArcGIS program to vamp up their maps.	