

# 3D Science Performance Assessment Tasks

## MIDDLE SCHOOL HUMAN IMPACT ON THE EARTH

*In Partnership with*



*3DSPA Assessment Tasks were developed by*



*A member of*



**MICHIGAN MATH & SCIENCE CENTERS NETWORK**

*In collaboration with*



*Shaping the Future Through Education*

**Gratiot Isabella RESD**



*These materials were developed under a grant awarded by the Michigan Department of Education*

<b>Task Title</b>	Human impact on the earth
-------------------	---------------------------

<b>Standards Bundle Information</b>
-------------------------------------

Performance Expectations

- MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

Science and Engineering Practices

- Constructing Explanations and Designing Solutions
- Engaging in Argument from Evidence

Cross-Cutting Concepts

- Cause and Effect

Disciplinary Core Ideas

- ESS3.C: Human Impacts on Earth Systems

CCSS ELA:

- WHST.6-8.7: Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-ESS3-3)
- WHST.6-8.8: Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-ESS3-3)
- RST.6-8.1: Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS3-4)
- WHST.6-8.1: Write arguments focused on discipline content. (MS-ESS3-4)
- WHST.6-8.9: Draw evidence from informational texts to support analysis, reflection, and research. (MS-ESS3-4)

CCSS Mathematics:

- 6.RP.A.1: Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS3-3)
- 7.RP.A.2: Recognize and represent proportional relationships between quantities. (MS-ESS3-3)
- 6.EE.B.6: Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS3-3)
- 7.EE.B.4: Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS3-3)

- 6.RP.A.1: Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS3-4)
- 7.RP.A.2: Recognize and represent proportional relationships between quantities. (MS-ESS3-4)
- 6.EE.B.6: Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS3-4)
- 7.EE.B.4: Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS3-4)

#### Overview / Introduction of the Assessment Task

Students will be given a scenario in which they are to analyze data to determine the cause of an increase in fish kills and algal blooms in a lake. Students will identify a minimum of 3 causal or correlational relationships and report out using Claim, Evidence and Reasoning. In addition, the students will design a solution to the problem.

#### Teacher Background

Teachers should be familiar with logistic and exponential growth curves. Teachers should also be familiar with the four earth systems and a variety of human impacts including but not limited to land use, water use, mineral use, pollution, overharvest, energy production, etc.

The next generation science standards require teachers to aid students in analyzing, interpreting and designing solutions to human impact issues. Students will be required to analyze and interpret graphs, charts, and images relevant to human impact cause and effects. The ability to overlay graphs may be an appropriate skill for students as they identify cause and effect relationships.

#### Information for Classroom Use

Connections to Instruction:

Salmon in the Classroom through the Department of Natural Resources may be a connection teachers can use to this unit. The Salmon in the Classroom resources can be found at the following website.

[http://www.michigan.gov/dnr/0,1607,7-153-10369\\_50075---,00.html](http://www.michigan.gov/dnr/0,1607,7-153-10369_50075---,00.html)

New applicants to the program must submit paperwork by April 15th.

Additional teacher resources for cross-curricular materials and science specific documents/videos can be found at the following website.

<http://fulton.schoolwires.net/Page/976>

Approximate Duration for the Summative Task: (all components)

The amount of time it will take for the students to analyze the data and developing an explanation will depend on the amount of background knowledge the students. This portion of the assessment will most

likely take 1 ½ days. The design process also varies depending on students revising and revisiting their designs but it is anticipated this portion will also take 1 ½-2 days.

#### Assumptions:

The 3DSPA was designed to assess students' ability to perform the task by applying previous knowledge learned to the new phenomena in the performance assessment without having been exposed to this specific phenomena in advance.

Students should have already completed content materials from ESS2: Earth Systems, and ESS3: Earth and Human Activity. Students should be familiar with content materials from ESS2.A: Earth Materials and Systems, ESS2.C: The roles of water in Earth's Surface Processes, ESS3.A Natural Resources, and prior knowledge from ESS3.C Human Impacts on Earth Systems.

In earth materials and systems students should be familiar with the four earth systems. These systems support a variety of ecosystems and organisms, shape landforms and influence climate.

In the role of water students should be familiar with the fact that water is found almost everywhere on Earth. They should be familiar with the basic aspects of the water cycle and major reservoirs of water.

In natural resources students should be familiar with all metals, energy, and fuels that humans use. They should also understand that these fuels are derived from natural sources, and their use and removal affects the earth in a variety of ways. Students should be familiar with the fact that some resources are renewable and others are nonrenewable.

In previous grade levels students should have become familiar with various human impacts on Earth Systems including the various human activities of agriculture, industry and everyday life. They should understand that these activities affect land, vegetation, bodies of water (ocean, streams, and lakes), and the air.

#### Materials Needed:

The materials needed for the summative assessment consist of data which can be found at the following link:

[https://docs.google.com/document/d/1d0tF7L1uJy9TRHk3qeO7XrDq\\_ZIH6EVGpZMMTIUeGNo/pub](https://docs.google.com/document/d/1d0tF7L1uJy9TRHk3qeO7XrDq_ZIH6EVGpZMMTIUeGNo/pub)

#### Supplementary Resources:

For more information about the three groups of macroinvertebrates click on the link provided.

<http://wupcenter.mtu.edu/education/stream/Macroinvertebrate.pdf>

The following resource may be helpful to you as you research information on water quality in freshwater lakes.

[https://www.michigan.gov/documents/deq/deq-ess-faq-water-wb-waterquality-inlandlake\\_206686\\_7.pdf](https://www.michigan.gov/documents/deq/deq-ess-faq-water-wb-waterquality-inlandlake_206686_7.pdf)

<http://extension.psu.edu/natural-resources/water/ponds/pond-management/pond-construction/interpreting-water-tests-for-ponds-and-lakes>

Article on phosphorus and nitrogen impacting water quality [http://epa.ohio.gov/Portals/35/wqs/Phos-Nitrogen\\_Impact\\_WQ\\_2011.pdf](http://epa.ohio.gov/Portals/35/wqs/Phos-Nitrogen_Impact_WQ_2011.pdf)

### Learning Performances

Students use graphs, charts and images to conclude that the human population has undergone exponential growth.

Students construct a claim based on evidence that predicts the impact of human population growth on earth systems and natural resource consumption using cause and effect.

Using multiple sources of information (such as graphs, charts and images), students use the design cycle to develop a solution which minimizes the human impacts on the environment.

Students create explanations using variables that identify causal or correlational relationships between human activities (fishing, mining, land use decisions, water usage, pollution) and their impacts.

Students use graphs, charts and images created from technologies that monitor human impacts on the environment, and use scientific reasoning to generate adequate explanations or conclusions.

Students create explanations that relate the independent variable of human population growth to the dependent variable of a given human impact on earth systems (changes to the appearance, composition and structure) and/or the consumption of natural resources (freshwater, mineral, and energy).

Using data, students construct written arguments to either refute or accept scientific explanations and solutions to factors that affect human sustainability.

# Performance Assessments

<b>Student Performances</b>		
<i>Formative Assessment Task 1</i>	<p>Learning Performance:</p> <p>Students use graphs, charts and images to conclude that the human population has undergone exponential growth.</p>	Expected Duration:
	<p>Description (Phenomena, Scenario, Task)</p> <p>Using graphs, charts and images students observe the current and past change in the human population.</p>	
	<p>Directions</p> <p>Identify the difference between logistic and exponential growth curves. Compare growth curves of populations of organisms (noting populations reaching the carrying capacity). Students should make the connection that the human population has not reached a carrying capacity due to the advancement of technologies.</p>	
<i>Formative Assessment Task 2</i>	<p>Learning Performance:</p> <p>Students construct a claim based on evidence that predicts the impact of human population growth on earth systems and natural resource consumption using cause and effect.</p>	Expected Duration:
	<p>Description (Phenomena, Scenario, Task)</p> <p>Students observe a variety of human impacts on the environment through research.</p>	
	<p>Directions</p> <p>The teacher should allow students to research a variety of impacts on the environment that are caused by humans. Some of the impacts could include; overfishing, endangered species, wetland development, estuary development, logging, mining, land use practices, water use practices, dams, pollution, etc. Students can choose their own human impact and present to their classmates the cause and effect relationships of these human impacts.</p> <p>Teachers may choose to complete the following lesson on Lake Erie deadzones. It should be noted that the activity may give too much background knowledge to students as they eventually perform their summative learning task.</p>	

	<a href="http://www.miseagrant.umich.edu/lessons/lessons/by-broad-concept/physical-science/dead-zones/">http://www.miseagrant.umich.edu/lessons/lessons/by-broad-concept/physical-science/dead-zones/</a>	
<i>Formative Assessment Task 3</i>	<p>Learning Performance:</p> <p>Students create explanations that relate the independent variable of human population growth to the dependent variable of a given human impact on earth systems (changes to the appearance, composition and structure) and/or the consumption of natural resources (freshwater, mineral, and energy).</p>	Expected Duration:
	<p>Description (Phenomena, Scenario, Task)</p> <p>Humans have a variety of impacts on natural resources and wildlife populations. In this activity students will identify the practice of conservation as a tool to help maintain healthy populations of wildlife.</p>	
	<p>Directions</p> <p>Students should watch the following video about the consumption of wildlife natural resources and how conservation has allowed species of organisms to rebound over time.</p> <p><a href="https://www.youtube.com/watch?v=IZ20zQwfmQE">https://www.youtube.com/watch?v=IZ20zQwfmQE</a></p> <p>Use the following documents to engage students in activities related to the video</p> <p><a href="https://www.nssf.org/PDF/UnEndangered_TG.pdf">https://www.nssf.org/PDF/UnEndangered_TG.pdf</a></p>	
<i>Formative Assessment Task 4</i>	<p>Learning Performance:</p> <p>Using data, students construct written arguments to either refute or accept scientific explanations and solutions to factors that affect human sustainability.</p>	Expected Duration:
	<p>Description (Phenomena, Scenario, Task)</p>	
	<p>Directions</p> <p>Human sustainability lesson:</p> <p><a href="https://www.pixton.com/schools/teacher-resources/lesson-plans/human-sustainability">https://www.pixton.com/schools/teacher-resources/lesson-plans/human-sustainability</a></p>	



<p><i>Final Task:</i></p>	<p>Learning Performance</p> <p>Students create explanations using variables that identify causal or correlational relationships between human activities (fishing, mining, land use decisions, water usage, pollution) and their impacts.</p>		
<p>Phenomena:</p> <p>Picture of Algae bloom and fish kill</p>		<p>Expected Duration:</p>	
<p>Goal: Students analyze a series of charts and graphs on water quality to determine the cause of a lake fish kill.</p>		<p>Role: Students take the role of a presenter at a town hall style meeting to concerned residents.</p>	
<p>Audience: Concerned citizens at a town hall meeting.</p>		<p>Situation: Rainbow Lake has seen an increase in fish kills and algal blooms. Students are provided with data and need to find three causal or correlational effects to produce a claim, evidence and reasoning report as well as design a solution.</p>	
<p>Product / Performance</p> <p>See link for full text containing data</p> <p><a href="https://docs.google.com/document/d/1d0tF7L1uJy9TRHk3qeO7XrDq_ZIH6EVGpZMMTIUeGNo/pub">https://docs.google.com/document/d/1d0tF7L1uJy9TRHk3qeO7XrDq_ZIH6EVGpZMMTIUeGNo/pub</a></p> <p>Students will present to a town hall style meeting. Presentation can take a variety of forms. The final product should include a claim as to the cause of the fish kills, evidence supports the claim (at least three), and reasoning for the statements being made. Finally, students must design a solution to the problem.</p>			
<p>Directions</p> <p>See link for full text containing data</p> <p><a href="https://docs.google.com/document/d/1d0tF7L1uJy9TRHk3qeO7XrDq_ZIH6EVGpZMMTIUeGNo/pub">https://docs.google.com/document/d/1d0tF7L1uJy9TRHk3qeO7XrDq_ZIH6EVGpZMMTIUeGNo/pub</a></p>			

# CheckBric

<p>Learning Performance:</p> <p>Students create explanations using variables that identify causal or correlational relationships between human activities (fishing, mining, land use decisions, water usage, and pollution) and their impacts.</p>					<b>Comments</b>						
<i>Insert Evidence Statements below:</i>											
Students create explanations that include claims that relate to how a variable or variables relate to another variable or set of variables.					1	2	3	4			
Students identify human activities (fishing, mining, land use practices, water usage, and pollution) and their impacts.					1	2	3	4			
Students identify relationships as causal or correlational, noticing that correlation is not necessarily causation.					1	2	3	4			
<i>LP Total:</i>											
<p>Learning Performance: Students create explanations that relate the independent variable of human population growth to the dependent variable of a given human impact on earth systems (changes to the appearance, composition and structure) and/or the consumption of natural resources (freshwater, mineral, and energy).</p>										<b>Comments</b>	
<i>Insert Evidence Statements here:</i>											
Students construct scientific explanations using data to support claims.					1	2	3	4			
Students will understand the impact that the growth of the human population has had on earth systems (changes to the appearance, composition and structure) and the consumption of natural resources (freshwater, mineral, and energy).					1	2	3	4			
Students describe cause and effect relationships to predict phenomena in natural or designed systems.					1	2	3	4			
<i>LP Total:</i>											

Learning Performance: Students use graphs, charts and images created from technologies that monitor human impacts on the environment, and use scientific reasoning to generate adequate explanations or conclusions.					Comments
<i>Insert Evidence Statements here:</i>					
Students apply scientific reasoning to generate adequate explanations or conclusions.	1	2	3	4	
Students use technologies that monitor human impacts on the environment.	1	2	3	4	
Students use graphs, charts and images to identify patterns in data.	1	2	3	4	
<i>LP Total:</i>					
Learning Performance: Using multiple sources of information (such as graphs, charts and images), students use the design cycle to develop a solution which minimizes the human impacts on the environment					Comments
<i>Insert Evidence Statements here:</i>					
Students design solutions, using the design cycle, supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.	1	2	3	4	
Students design a solution using technologies that minimizes human impacts on the environment	1	2	3	4	
Students use graphs, charts and images to identify patterns in data.	1	2	3	4	
<i>LP Total:</i>					
<i>Checkbric Total:</i>					

<b>4 Exemplary</b>	Work at this level is of exceptional quality. It is both thorough and accurate. It exceeds the standard. It shows a sophisticated application of knowledge and skills.
<b>3 Proficient</b>	Work at this level meets the standard. It is acceptable work that demonstrates application of essential knowledge and skills. Minor errors or omissions do not detract from the overall quality.
<b>2 Developing</b>	Work at this level does not meet the standard. It shows basic, but inconsistent application of knowledge and skills. Minor errors or omissions detract from the overall quality. Your work needs further development.
<b>1 Emerging</b>	Work at this level shows a partial application of knowledge and skills. It is superficial (lacks depth), fragmented or incomplete and needs considerable development. Your work contains errors or omissions.

## Item Production Information

### Copyrighted Material and Sources

Salmon in the Classroom through the Department of Natural Resources may be a connection teachers can use to this unit. The Salmon in the Classroom resources can be found at the following website.

[http://www.michigan.gov/dnr/0,1607,7-153-10369\\_50075---,00.html](http://www.michigan.gov/dnr/0,1607,7-153-10369_50075---,00.html)

New applicants to the program must submit paperwork by April 15th.

Additional teacher resources for cross-curricular materials and science specific documents/videos can be found at the following website.

<http://fulton.schoolwires.net/Page/976>

For more information about the three groups of macroinvertebrates click on the link provided.

<http://wupcenter.mtu.edu/education/stream/Macroinvertebrate.pdf>

The following resource may be helpful to you as you research information on water quality in freshwater lakes.

[https://www.michigan.gov/documents/deq/deq-ess-faq-water-wb-waterquality-inlandlake\\_206686\\_7.pdf](https://www.michigan.gov/documents/deq/deq-ess-faq-water-wb-waterquality-inlandlake_206686_7.pdf)

<http://extension.psu.edu/natural-resources/water/ponds/pond-management/pond-construction/interpreting-water-tests-for-ponds-and-lakes>

Article on phosphorus and nitrogen impacting water quality [http://epa.ohio.gov/Portals/35/wqs/Phos-Nitrogen\\_Impact\\_WQ\\_2011.pdf](http://epa.ohio.gov/Portals/35/wqs/Phos-Nitrogen_Impact_WQ_2011.pdf)

<http://www.miseagrant.umich.edu/lessons/lessons/by-broad-concept/physical-science/dead-zones/>

<https://www.youtube.com/watch?v=IZ20zQwfmQE>

Use the following documents to engage students in activities related to the video

[https://www.nssf.org/PDF/UnEndangered\\_TG.pdf](https://www.nssf.org/PDF/UnEndangered_TG.pdf)

Human sustainability lesson: <https://www.pixton.com/schools/teacher-resources/lesson-plans/human-sustainability>