

Earth & Space Sciences

Changes in Earth's Surface

Year 4 Unit of Inquiry

Planeteers Game-based Learning Platform

Science and Technology, Arts, Math and Engineering



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Outcomes and Content

Science and Technology

Curriculum Content Code: ACSSU075

Learning Outcomes

Explains how the Earth's surface changes over time as a result of natural processes and human activity

Standards: Changes in Earth's Surface

1. How does the Earth's surface change over time as a result of natural processes and human activity?
2. How can people minimize the effects of changing landscape on property while still protecting the environment, such as estuaries and intertidal zones?
3. What factors affect how quickly landscapes change?
4. How will you explain the interactions among living things and nonliving things?
5. Why is there a need to protect and conserve estuaries and intertidal zones?
 - Consider how different human activities cause erosion of the Earth's surface
 - Generate and compare multiple solutions to reduce the impacts of natural Earth processes on human
 - Discuss the protection and conservation of intertidal zones and estuaries
 - Design and build real world projects such as man-made intertidal zones or rock formations

Engineering

STEAM Curriculum Code: EN1.1 | EN1.2

Learning Outcomes

Identifies and creates simple 'natural' relationships

Standards: Natural and Built Environments, Design Process for Innovation

1. How will you design a recreation of an estuary to model natural environment?
2. What are the elements needed in terraforming a land to recreate an estuary or intertidal zone?
 - Identify simple cause and effect relationships or interactions in the environment
 - Apply design thinking to build and create real world projects
 - Demonstrate how purpose can impact design
 - Design local environment to meet immediate needs

Arts and Mathematics

Learning Outcomes

Constructs 3-D projects as models for natural or man-made places in the community using primary and secondary colors, geometric shapes, space, and repetition of colors to show balance of the structure and shape.

Standards: Elements of design and Geometry

1. What shapes should be used to model estuaries and intertidal zones and show how organisms interact to survive?
 - Demonstrate understanding of lines, colors, space and harmony through creating 3D models of natural or man-made places in the community with the use of 3D objects, and the right proportions of parts
 - Visualize, name, and describe polygons with 5 or more sides
 - Construct polygons, circles, and solid figures

Social Studies

Learning Outcomes

Develops awareness on how to protect and conserve estuaries and intertidal zones

Standards: Environmental Awareness, Conservation and Protection as Social Responsibility

1. How do humans benefit from estuaries and intertidal zones?
2. What are the ways to conserve and protect our natural environment?
3. What are the importance of protecting and conserving estuaries and intertidal ecosystem?
 - Explore and journalize practices in preserving the Earth's surface and natural environment

Unit Summary

Grade:

4

Subject:

Science, Technology,
English, Arts and Math

Duration:

1 week (50 minutes/day)

Syllabus Mapping:

- Earth and Space
- Elements of Design
- Geometry
- Design Process for Innovation
- Making

Integration:

- Science
- Mathematics
- Arts
- Engineering
- Technology

Outcomes:

ACSSU075

Inquiry and Focus Questions:

Driving Question:

Considering the changes caused by human activities in the landscape of the Earth's surface, how do we protect and conserve the natural environment, such as estuaries and intertidal ecosystem?

Science and Technology Inquiries:

- How does the Earth's surface change over time as a result of natural processes and human activity?
- How can people minimize the effects of changing landscape on property while still protecting the environment, such as estuaries and intertidal zones?
- What factors affect how quickly landscapes change?
- How will you explain the interactions among living things and nonliving things?
- Why is there a need to protect and conserve estuaries and intertidal zones?

Engineering Inquiries:

- How will you design a recreation of an estuary to model natural environment?
- What are the elements needed in terraforming a land to recreate an estuary or intertidal zone?

Social Studies Inquiries:

- How do humans benefit from estuaries and intertidal zones?
- What are the ways to conserve and protect our natural environment?
- What are the importance of protecting and conserving estuaries and intertidal ecosystem?

Learning across the Curriculum:

Cross-curriculum priority

- Sustainability
- Environmental Protection and Awareness

General Capabilities

- Teamwork & Collaboration
- Critical & Creative Thinking
- ICT Capability
- Numeracy
- Literacy
- Community Awareness

Skills Focus:

Working Scientifically

- Communicating
- Questioning and predicting

Design and Production

- Researching and planning
- Design and innovation
- Producing, implementing, testing, refining

Skills Focus:

This unit of investigation explores concepts from the core science standards for Earth and Space Sciences, with a focus on changes in the Earth's surface as a result of natural processes and human activity. Students use an individual inquiry-based approach to re-create a sustainable estuarine and intertidal ecosystems. They experiment with a number of in-game tasks to explore various interactions, and how estuaries are formed such as with plants, animals, humans, and other nonliving things. They learn about sustainable practices in protecting and conserving the natural environment, especially the surrounding coastal habitats.

Teaching, Learning & Assessment Activities

NOTE: 'Quest Game Activity' describes activities that happen in-game while 'Unplugged' occur outside the game

Lesson 1: Project Orientation and Research

Summary: Teacher explains the basic about the Earth's surface and how it changes over time as a result of natural processes and human activity. Teacher explains that estuaries are formed by rising sea levels and these activities and other micro-organisms affect and help shape the environment. As part of the project-based lesson, the teacher poses a challenge on recreating a hypothetical community in an intertidal zone or estuarine ecosystem to portray a sustainable environment where organisms, both living and nonliving things, thrive. Students are tasked with researching about how living and non-living things interact in an estuary, how these interactions relates to the changes in natural landscapes and how to protect and conserve estuaries and intertidal zones.

Assessment: Quiz on changes on the Earth's surface (10 minutes)

Unplugged Activity: Driving Question (15 minutes) – Brainstorm (Guided)

Begins with a discussion about how human interaction with an ecosystem impacts the ecosystem, either positively or negatively.

Teachers says "Estuaries were formed by rising sea levels, as the sea rose, it drowned river valleys and filled glacial troughs, forming estuaries. Estuaries play an important part in our lives. Once formed, estuaries become traps for sediments – mud, sand and gravel carried in by rivers, streams, rain and run-off and sand from the ocean floor carried in by tides. They are factors that help shape the earth's surface. It also provides a rich feeding grounds for coastal fish and migratory birds, and drowning areas for fish and shellfish. It is important that everyone helps to protect estuaries and conserve the valuable resources ins estuarine ecosystem."

Teacher poses driving questions for the students to investigate and discover possible solutions:

Q. Considering the changes caused by human activities in the landscape of the Earth's surface, how do we protect and conserve the natural environment, such as estuaries and intertidal ecosystem?

Science and Technology Inquiries:

- How does the Earth's surface change over time as a result of natural processes and human activity?
- How can people minimize the effects of changing landscape on property while still protecting the environment, such as estuaries and intertidal zones?
- What factors affect how quickly landscapes change?
- How will you explain the interactions among living things and nonliving things?
- Why is there a need to protect and conserve estuaries and intertidal zones?

Engineering Inquiries:

- How will you design a recreation of an estuary to model natural environment?
- What are the elements needed in terraforming a land to recreate an estuary or intertidal zone?

Social Studies Inquiries:

- How do humans benefit from estuaries and intertidal zones?
- What are the ways to conserve and protect our natural environment?
- What are the importance of protecting and conserving estuaries and intertidal ecosystem?

Lesson 1: Project Orientation and Research (Continued)

Project Orientation (5 minutes)

- Teacher introduces the project and relates it to the discussion outcomes
- Teacher divides the class in research groups (recommend 4-6)
- Provides project guide and overview of the timeline of activities and assessments to students (organized by lesson)

Research and Design Journal (20 minutes)

- Students research and watch documentary videos about ecosystem in estuaries and intertidal zones.

Science and Technology Inquiries:

- How can people minimize the effects of changing landscape on property while still protecting the environment?
- What factors affect how quickly landscapes change?
- How do water, ice, wind, and vegetation sculpt landscapes?
- How will you explain the interactions among living things and nonliving things?
- Why is there a need to protect and conserve estuaries and intertidal zones?

Engineering Inquiries:

- How will you design a recreation of an estuary to model natural environment?
- What are the elements needed in terraforming a land to create an enclosed coastal body of water that form a transition zone between river and sea?

Social Studies Inquiries:

- How do humans benefit from estuaries and intertidal zones?
- What are the ways to conserve estuaries at home, along the waterfront, at the beach, and in your community?

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- Students brainstorm, draft their design and plans on a sheet of paper or project journal**

** If teachers run out of time in the lesson to meaningfully allocate time for this exercise, students can be given the design plan during extra time.

Lesson 1 Assessment Ideas

Teachers should consider different assessment options throughout the project phases, including for example:

1. Quiz on changes on the Earth's surface
2. Quality of student research and project journal
3. Design thinking and reasoning, problem solving
4. Group skills, time management, collaboration
5. Project works (later lessons)
6. Photo Essay (later lessons)

Lesson 2: Recreate an intertidal zone through terraforming

Introduction to the Lesson

Teacher guides the students in restructuring the landform into an estuarine using the gauntlet in the game. They should be able to model and describe how an estuarine ecosystem is formed and depict a hypothetical community in an estuarine ecosystem. Students should be able to explain and describe the interactions and threats between humans and the estuarine ecosystem.

Teacher-Led Unplugged Activity (10 minutes)

- Teacher gives an overview of lesson goals, and reiterates the driving question.
- Teacher gives students the opportunity to ask questions before beginning their prototype.

Game Sandbox Activity (30 minutes)

In-Game Prototype:

1. Use the gauntlet to terraform an estuary and intertidal zone from the ocean.
 - Ideally, estuaries should be partially enclosed coastal body of brackish water with one or more rivers or streams flowing into it, and with a free connection to the open sea.
 - Experiment on its structure—could be wider at the beginning, then thinner at the end.
2. Use the Builder tool to construct buildings depicting a bay in an estuarine zone.
 - The buildings should also be distant to the intertidal or estuarine area, students should be able to explain the threats of land developments and reclamation.
 - Ideally, the buildings should show how its construction affects the estuarine ecosystem.

Documentation using Game Camera:

- Using the Camera, students should take pictures of their model intertidal zone area at different angles.
- Student should be able to put captions and description of each photo describing the estuarine area.
- Later, in lesson 5, the photos will be used in their reflection and presentation i.e. they will create a photo essay and present their project in class.

Lesson 2 Assessment Ideas

Teachers should consider different assessment options throughout the project phases, including for example:

1. Quality of student research and project journal
2. Design thinking and storytelling, explaining modeled area and buildings in relation to the effects of these set-up to the ecosystem
3. Engineering approach, including aspect, estuarine geographical area and other considerations students should describe/explain
4. Time management, collaboration, problem-solving skills

Lesson 3: Exploration and Documentation

Introduction to the Lesson

Students explore the environment surrounding the estuaries and intertidal zones they've recreated by taking pictures using the in-game camera. Then can do so by letting their character travel by foot or by taking vehicles such as rover or even airplane. They should take land, underwater, and even aerial photos to capture different angles of their estuaries and intertidal zones. To document their exploration, students should explain the photos they've taken using the Mission Journal in game.

Teacher-Led Unplugged Activity (10 minutes)

- Teacher gives an overview of lesson goals, and reiterates the driving question.
- Teacher gives students the opportunity to ask questions before beginning their exploration in game.

Game Sandbox Activity (30 minutes)

Exploration using Game Camera

- Have a photo survey of the environment surrounding the estuaries and intertidal zones (i.e. include before and after photos).
- Students should explore the area and take pictures by letting their character walk or ride vehicles.
- They should take pictures of the environment using different angles from land, water or even aerial view.
- In taking pictures, they would need to adjust their zoom for the perfect shot.
- A close-up is great for detail, especially for animals or plants, and small creatures, too.
- A mid shot is farther away than a close-up, and is used to capture a subject when they want a mix of the detail they get in a close up, and a picture that shows more of the character or characters.
- If the students zoom out further to capture the character and more of their environment, that's called a full shot.
- In taking pictures underwater, the students must be sure to master their diving skills so that they can adopt a stable position under water to take good shots.
- They should set the camera's flash to "on" since there is less light in the deep, and look for close up rather than mid shots and long shots to avoid water blur or distortion.
- Later, in lesson 5, the photos will be used in their reflection and assessment i.e. they will create a photo essay about their project.

Documentation using Mission Journal

1. Using the game's *Mission Journal*, students should explain the photos they've taken (i.e photo taken from a mountain view, underwater).
2. Students should add notes on their journal describing the interactions among living and nonliving things in an intertidal and estuarine ecosystem.

Lesson 3 Assessment Ideas

Teachers should consider different assessment options throughout the project phases, including for example:

1. Photography skills
2. Creativity, time-management, critical thinking skills
3. Reasoning and storytelling, explaining the relationships and interactions among living and nonliving things in an intertidal and estuarine ecosystem

Lesson 4: Project Finalization

Introduction to the Lesson

Teacher explains the importance of estuaries and on how it helps shape the Earth's landscape and provides a wide range of resources, benefits, and services to humans and the ecosystem. Teacher highlights that estuaries are irreplaceable natural resource that must be managed carefully for the mutual benefit of all who enjoy and benefit on them and that it is important to be aware of the threats caused by human construction.

Teacher-Led Unplugged Activity (10 minutes)

- Teacher gives an overview of lesson goals.
- Teacher gives students the opportunity to ask questions before using game to finalize their designs/project.

Game Sandbox Activity (30 minutes)

Final Project

1. Use the *Builder tool* to make any final improvements to the modeled estuarine area and constructed community.
2. Students should be able to plant crops and build a farm around the estuarine area.
 - Ideally, the kinds of plants that are good for farming near an estuary are mangroves, seagrass, salt marsh, shrubs, etc.
3. Students should finalize any and all additional design strategies in making their estuarine area similar to the current real life estuarine environment.

Documentation using Game Camera

- Students should take photos to illustrate and record their final look of the area for presentation.
- Later, in lesson 5, the photos will be used in their reflection and presentation i.e. they will create a photo essay and present their project in class.
- With their project complete, students should write captions of each photo taken using the mission journal.
- They should describe how estuaries are formed and how the community they built affect the life forms or different habitats in the estuarine ecosystem.

Lesson 4 Assessment Ideas

Teachers should consider different assessment options throughout the project phases, including for example:

1. Quality of student research and project journal
2. Design thinking and storytelling, explaining modeled area and buildings in relation to the effects of these set-up to the ecosystem
3. Engineering approach, including aspect, estuarine geographical area and other considerations students should describe/explain
4. Time management, collaboration, problem-solving skills

Lesson 5: Presentation and Reflection

Introduction to the Lesson

Teacher asks the students to write about their project, their estuary recreation design plan, and design thinking using the game's photo essay tools.

Game Sandbox Activity (30 minutes)

Photo Essay

1. Using the game's *Mission Log*, students finalize their photo essay about the project.
2. In the photo essay students, should organize and name photos by activity and stage of the project, and insert them into their essay.
3. For example, some questions students might be asked to answer in their photo essay, may include:
 - How does the Earth's surface change over time as a result of natural processes and human activity?
 - How can people minimize the effects of changing landscape on property while still protecting the environment?
 - What factors affect how quickly landscapes change?
 - How will you explain the interactions among living things and nonliving things in an estuarine environment?
 - Why is there a need to protect and conserve estuaries and intertidal zones?
 - How do humans benefit from estuaries and intertidal zones?
 - How do living and nonliving help shape the earth's landscapes?
 - What are the threats to the estuary and intertidal zones?
 - What are the ways to conserve and protect our natural environment?
 - What kind of crops are good for farming in estuary zones?

Assessment: *Post-test about changes on the Earth's surface (10 minutes)*

Final Assessment

1. Photo essay
2. Post-test about ecosystem, weathering, estuaries and intertidal zones
3. Previous assessments made during the other lessons

Teacher Handy Links and Resources

From Us to You!

- Learn more about estuaries, threats to it, and ways to restore it. [READ](#)
- Why are estuaries important? [READ](#)
- Check out a study about Marine Ecosystem: Estuaries [HERE](#)

Other Multimedia Resources

- Check out these facts about [estuaries](#). [WATCH](#)
- Learn more about estuaries in motion. [WATCH](#)
- Check out these videos and article on how estuaries and water cycles shape the earth's surface. [WATCH](#)
- See how you can help conserve nature. [WATCH](#)

Other Reference Material

- Australian Curriculum (ACARA) Science Sequence of Content F-6: Strand [READ](#)

Support & Help

Please feel free to contact the STEAM Craft Edu team for any inquiries or support needs

Email: education@steamcraftedu.com