



STORYLINE

UNIT 4.3: WHAT CAUSES LAND AND THINGS ON IT TO CHANGE? HOW CAN WE REDUCE THE IMPACTS ON HUMANS?

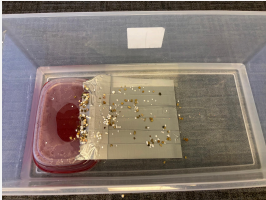
Lesson Set One • Lessons 1-8

Lesson	Phenomenon	What we do	What we figure out
Lesson 1 Anchoring Phenomenon <i>What caused the changes in Acadia National Park?</i>	 <p>A natural event damaged a road and changed the land in Acadia National Park.</p>	<p>Make observations of Acadia National Park.</p> <p>Gather and share ideas and experiences from our community, as well as other examples of when the land changed.</p> <p>Create an initial individual model and Class Consensus Model to describe what we think caused the road and land around it to change.</p> <p>Create our Driving Question Board and generate Ideas for Investigations.</p>	<p>Something happened that was strong enough to move rocks and destroy Seawall Road in Acadia National Park.</p> <p>The ground was broken, and many rocks were moved around.</p> <p>Wind, water, and/or ground shaking might be the causes of these changes.</p>


↓ Navigation to next lesson: *Now that we think that maybe water, wind, and/or ground shaking could have caused the changes we observed in Acadia, we want to figure out what type of events can happen in Acadia that could have destroyed the road.*

Lesson 2 Investigation <i>What happened in Acadia when the damage occurred?</i>	 <p>Natural hazards can happen in different places, at different times, and have different effects.</p>	<p>Analyze data from Acadia the week the damage happened.</p> <p>Collect and analyze data about patterns of what occurs during various natural hazards</p> <p>Come to a consensus about what happened to cause the damage in Acadia.</p> <p>Read a book about storms.</p> <p>Update our How Land and Things on It Can Change chart</p>	<p>Various hazards from natural processes have different data associated with them.</p> <p>A strong coastal storm happened in Acadia when the damage occurred.</p> <p>Data from the week the damage happened in Acadia shows that there were especially high waves and winds.</p>
--	---	--	---

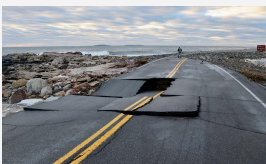
↓ Navigation to next lesson: *Now that we know that big waves were an important part of what happened that week in Acadia, we are wondering how big waves may have moved rocks and broken Seawall Road.*

<p>Lesson 3</p> <p>Investigation</p> <p><i>How do waves move things?</i></p>	 <p>Waves in a wave bin model move gravel differently depending on the depth of the water.</p>	<p>Observe a wave bin as a class and plan a model that includes the shore.</p> <p>Develop a wave bin model and use it to investigate how gravel moves near the shore.</p> <p>Ask more questions about waves.</p>	<p>Waves in deeper water do not move things forward.</p> <p>Waves can move things near shore.</p>
---	---	--	---


↓ Navigation to next lesson: *Now that we know that some waves can move things forward when near a shore, we are wondering if the size of waves can change the way they move things.*

<p>Lesson 4</p> <p>Investigation</p> <p><i>What causes large waves to form?</i></p>	 <p>Wind causes a variety of wave patterns.</p>	<p>Observe wave patterns using a cloth sheet.</p> <p>Investigate questions about the role of wind in wave formation, using wave bins.</p> <p>Update our consensus model with ideas from recent investigations.</p>	<p>Waves have different patterns that include different heights of waves (amplitude) and different spacing between waves (wavelength).</p> <p>Waves are created in a storm when the surface of the water is disturbed by wind.</p>
--	--	--	--


↓ Navigation to next lesson: *Now that we figured out how storms create big waves that can move rocks, we wonder how the storm might cause a road to crack.*

<p>Lesson 5</p> <p>Putting Pieces Together</p> <p><i>How could waves cause something like a road to break?</i></p>	 <p>Waves quickly changed the road and the land around it.</p>	<p>Use the wave bins to investigate how water waves can change a road.</p> <p>Update our consensus model to include our new ideas about waves.</p> <p>Use our science ideas to explain how a shipwreck was uncovered during the same storm in Acadia.</p>	<p>High-amplitude waves have enough force to remove or push rocks out from under a road.</p> <p>Sometimes waves add to the land and things on it, and other times, waves can take away from the land and things on it.</p>
---	---	---	--


↓ Navigation to next lesson: *Now that we have figured out how waves can quickly change things, like a road, we are wondering if they can also change things slowly, like Acadia's Thunder Hole.*

<p>Lesson 6</p> <p>Investigation</p> <p><i>How are places like Thunder Hole changing?</i></p>	 <p>Thunder Hole and other national park sites look like they formed in interesting ways.</p>	<p>Estimate how long it might have taken for Thunder Hole to form.</p> <p>Compare Thunder Hole's formation to Seawall Road's breaking.</p> <p>Obtain information about weathering and erosion mechanisms.</p> <p>Observe images of and data from national park sites, looking for evidence of different weathering and erosion mechanisms.</p>	<p>Weathering is when the land is broken up by outside forces.</p> <p>Erosion is when land is moved by outside forces.</p> <p>Weathering and erosion can happen through mechanisms beyond wind and waves, including rainfall, flooding, and living things.</p> <p>We see initial evidence of different weathering and erosion mechanisms at national park sites.</p>
--	--	--	--

↓ Navigation to next lesson: *Now that we have figured out different ways weathering and erosion could be working at national park sites, we wonder how we can gather more evidence for our proposed mechanisms.*

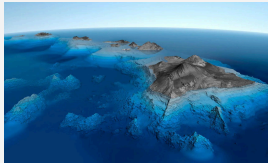
<p>Lesson 7</p> <p>Investigation</p> <p><i>What evidence can we gather about how land changes without waves?</i></p>	 <p>Land in different national parks has changed at different rates.</p>	<p>Investigate the causes of changes to land in various national parks.</p> <p>Communicate the cause of change to the land in our national park with our peers.</p> <p>Discuss the patterns in the causes of change to the land that we noticed.</p> <p>Obtain information from an article about how fossils provide evidence of land changing.</p>	<p>Wind, water, ice, and falling can break land apart (weathering) and move it to different places (erosion).</p> <p>Land can change quickly and/or slowly depending on how erosion happens.</p> <p>Some land has rock layers that we can see, and fossils in those layers can tell us how the land was in the past.</p>
---	---	---	--

↓ Navigation to next lesson: *Now that we have figured out how weathering and erosion can change land in different ways, we wonder how they have changed land in our communities.*


<p>Lesson 8</p> <p>Putting Pieces Together</p> <p><i>How does erosion change land and things on it in our communities?</i></p>	 <p>Land changes in our community like we've seen in the national parks.</p>	<p>Observe changes to land and things on it in our own community.</p> <p>Discuss which mechanisms of erosion caused these changes.</p> <p>Observe changes to land and things on it in a Montana community.</p> <p>Determine what caused the changes to the land there.</p>	<p>There is evidence of changes to land caused by wind/ice/falling/rainfall/water around the world, including our community.</p>
---	---	--	--

↓ Navigation to next lesson: *Now that we have noticed that most of the examples of mechanisms we have investigated are changing land in a destructive way, we wonder if any of the mechanisms we've listed would make new land, like lava, so we want to investigate that next.*

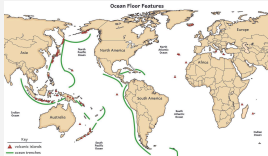
Lesson Set Two • Lessons 9-12

Lesson	Phenomenon	What we do	What we figure out
<p>Lesson 9</p> <p>Investigation</p> <p><i>How can lava from volcanoes form new land, and how do we know?</i></p>	 <p>Hawai'i was formed from many layers of lava building up.</p>	<p>Look at maps of Hawai'i.</p> <p>Read about rock layers in Hawai'i.</p> <p>Use wax to model how lava could flow.</p> <p>Develop and revise a model of how layers of lava can make new land, like an island.</p>	<p>When volcanoes erupt, lava flows out. When lava hardens, it turns into rock. Every time this happens, a new layer of rock is formed.</p> <p>As new layers of rock build up under the water, islands can form.</p> <p>Scientists have found evidence of layers that show different eruptions.</p>

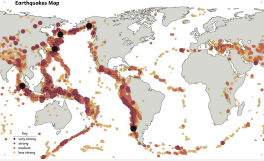
↓ Navigation to next lesson: *Now that we figured out that layers of lava can make new land, like an island, we are wondering what happens to the things on the land when there is an eruption.*

<p>Lesson 10</p> <p>Investigation, Putting Pieces Together</p> <p><i>How can there be so many plants on the island of Hawai'i?</i></p>	 <p>Plants regrow after volcanic eruptions in some places more than others.</p>	<p>Make observations of lava changing the land.</p> <p>Analyze and interpret rainfall data from maps and photos on the island of Hawai'i.</p> <p>Construct an explanation of how plants can regrow after a volcanic eruption.</p> <p>Read about lava trees and tree molds.</p>	<p>The amount of rainfall in an area affects the number of living things that are found there.</p> <p>Plants can help break rock layers, which can result in making more plants able to grow.</p> <p>Lava trees and tree molds provide evidence of what the landscape of the area was like in the past.</p>
---	--	--	---

↓ Navigation to next lesson: *Now that we figured out that volcanoes can cause a lot of destruction to land, we are wondering if we could predict where volcanoes might happen.*


<p>Lesson 11</p> <p>Investigation</p> <p><i>How can we predict where other volcanic eruptions might happen?</i></p>	 <p>There are patterns in the locations of Earth's features.</p>	<p>Analyze data on maps of the ocean floor in order to locate volcanoes.</p> <p>Describe patterns in the locations of the ocean floor and land features.</p> <p>Use patterns to determine which areas would be more likely to have a volcanic eruption.</p>	<p>The locations of mountain ranges, deep ocean trenches, seamounts, and volcanoes occur in patterns.</p> <p>Maps can help locate the different land and water features of Earth.</p> <p>Patterns in the locations of volcanoes can be used to predict where other volcanoes are located.</p>
--	---	---	---

↓ Navigation to next lesson: *Now that we figured out that we can use maps to predict where volcanic eruptions might happen, we are wondering if we can predict where other natural hazards might happen.*


<p>Lesson 12</p> <p>Investigation, Putting Pieces Together</p> <p><i>How might we predict other natural hazards around the world?</i></p>	 <p>Earthquakes and other natural hazards occur in somewhat predictable locations around the world.</p>	<p>We examine maps jigsaw-style for patterns in where different hazards occur and which people are impacted.</p> <p>We make connections to places we care about.</p> <p>We complete an exit ticket to reflect on what we have figured out.</p>	<p>Hazards can often be predicted by proximity to land and water features, such as mountains or oceans.</p> <p>These processes are too big to stop, but maybe we could do something to make sure people and places are not impacted as much.</p>
--	--	--	--

↓ Navigation to next lesson: *Now that we figured out where natural hazards are most likely to impact people, we want to figure out how we could protect people and places from natural processes.*


Lesson Set Three • Lessons 13-16

Lesson	Phenomenon	What we do	What we figure out
<p>Lesson 13</p> <p>Investigation</p> <p><i>What places need protecting from natural processes, and how can people do that?</i></p>	 <p>Communities use different solutions to protect themselves from natural processes.</p>	<p>We share initial ideas to protect people and places from natural processes.</p> <p>We read about solutions other communities have tried.</p> <p>We brainstorm our own solutions for Seawall Road.</p> <p>We develop criteria and constraints.</p>	<p>Different communities take different approaches to protect themselves from natural processes. Some might be applicable to protect Seawall Road.</p> <p>With past research as support, we have lots of ideas for possible solutions.</p> <p>We can use criteria and constraints to narrow down possible solutions.</p>


↓ Navigation to next lesson: *Now that we have identified a problem and some possible solutions, we can use our criteria and constraints to narrow down the possibilities.*

<p>Lesson 14</p> <p>Investigation</p> <p><i>How can we design a solution that could protect Seawall Road?</i></p>	 <p>Our earlier research helps us design solutions that are based on criteria and constraints.</p>	<p>We compare our brainstormed solutions to decide which attends to which criteria and constraints.</p> <p>We create a draft design solution in small groups.</p> <p>We go on a gallery tour to see other groups' design solution drafts and give each other feedback.</p> <p>We revise our draft design solution based on peer feedback.</p>	<p>Earlier research about weathering and erosion supports design solutions that minimize the impacts.</p> <p>Criteria and constraints support the development of engineering design solutions.</p> <p>Communication with peers can lead to improved designs.</p>
--	---	---	--

↓ Navigation to next lesson: *Now that small groups have revised design solutions, we are ready to build, test, and compare our engineering designs.*

<p>Lesson 15</p> <p>Investigation</p> <p><i>How can we test and compare solutions to protect places from natural processes?</i></p>	 <p>Comparing designs helps us figure out how to improve them.</p>	<p>We build and test our designs.</p> <p>We work with another group to closely observe the results of our designs.</p> <p>We compare the results of our designs as a class.</p>	<p>Planning for a solution helps make sure the design aligns to the criteria and constraints.</p> <p>Careful observation of a test helps to compare the results of different designs to prevent erosion.</p> <p>Communicating with peers can help make comparisons of the testing results.</p>
--	---	---	--

↓ Navigation to next lesson: *Now that we have improved our solutions, we wonder if we could apply our design thinking to a problem at a different national park.*

<p>Lesson 16</p> <p>Putting Pieces Together</p> <p><i>How can we use our engineering process to suggest a solution that reduces erosion in Indiana Dunes National Park?</i></p>	 <p>Design solutions can help reduce erosion in Indiana Dunes National Park.</p>	<p>Read about scientists who investigate coastal erosion.</p> <p>Apply our engineering process to suggest a solution that can reduce erosion.</p> <p>Return to our DQB to reflect on our progress.</p>	<p>Observations of tests help to compare the results of different designs to prevent erosion.</p> <p>Criteria and constraints can be used to compare solutions to determine which may be best for a problem.</p> <p>Investigating land in National Parks helps us explain how land and the things on it can change.</p>
--	---	--	---