Video Discussion Guide — *Marine Field Station: The Retreat*

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Activity Description: Like many places along the coast, the Rutgers University Marine Field Station in coastal New Jersey faces the impacts of climate change. For years, station scientists have been advising nearby communities on how to face the realities of climate change. Can they follow the same advice they give others? What actions will they take, and what will be learned? This guide is designed to help facilitate classroom discussion around retreat; the phenomenon of people in coastal communities moving inland to reduce threats to their lives and livelihood caused by sea level rise. The guide provides background information, discussion prompts, complementary hands-on activities for high school students and a facilitator's guide to deliver the interactive lesson.

Grade levels: 9-12

Subject Areas: Environmental Science, Earth Science, Climate Science, Marine Science, Oceanography, Geography, Social Science, and Social Studies

Activity Duration: 40-50 minutes*
*not including optional, complementary activities

Education Standards:
NGSS:HS-ESS3-1 and 2

This lesson aligns with the New Jersey Student Learning Standards for Climate Change Education by engaging students in analyzing local impacts of climate change (sea level rise), evaluating adaptation strategies, and reflecting on the role of scientific research in supporting coastal resilience. Students develop climate literacy by connecting scientific evidence to community-level decision making and personal responsibility.

Materials

- *Marine Field Station: The Retreat* (10:54 minute run time): https://coastalhub.org/beyondtheresearch/documentaryfilms/
- Discussion Guide slide deck
- Additional materials may be needed for optional, complementary hands-on activities

Before You Watch

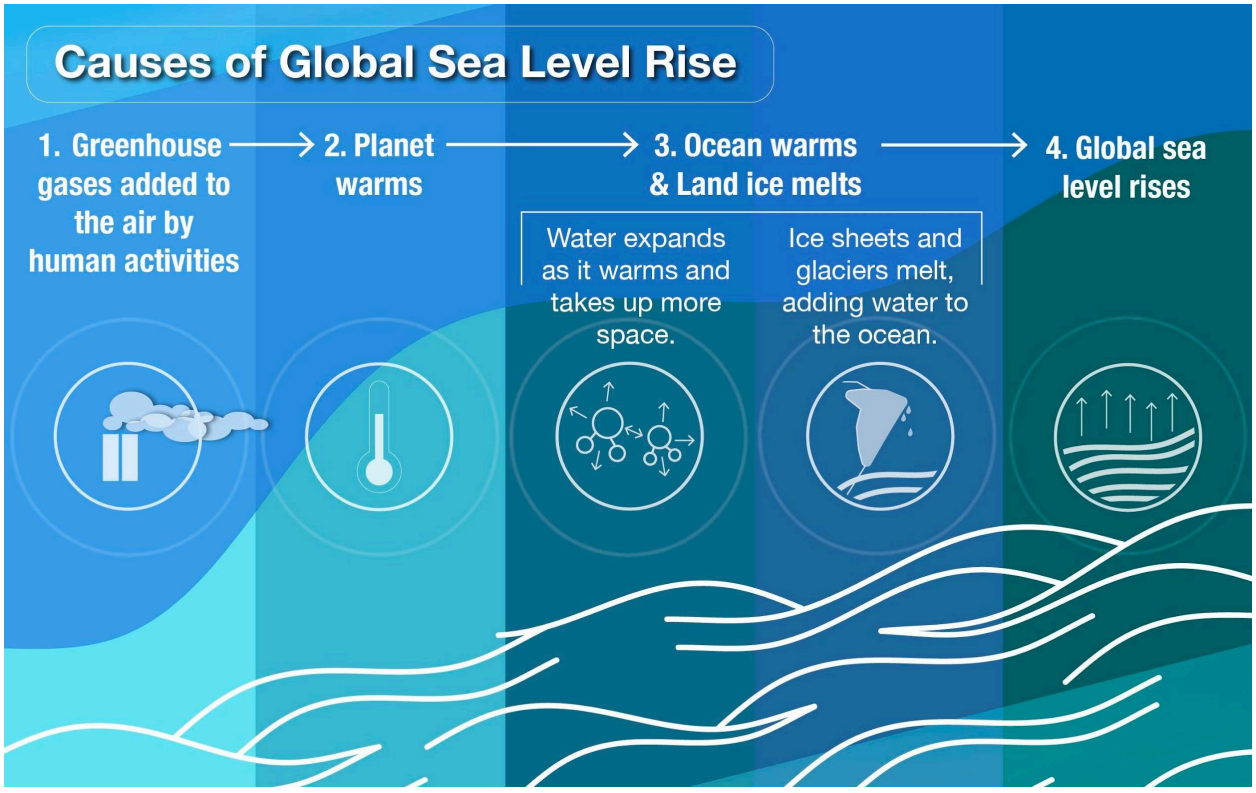
Prepare students with context about sea level rise and climate change and ask them the pre-viewing prompt questions. Depending on the students' existing knowledge of climate change, the background information can be shared before or after the discussion questions.

Optional: Utilize one of the primer activities listed below with students before watching the film.

Background Summary:

Global Context about Sea Level Rise: The Basics (Source: NASA)

- Greenhouse gases added to the atmosphere by human activities are warming the planet.
- Global sea level is rising mainly from ocean warming and melting land ice due to climate change.
- Global sea level is rising faster today than it was 100 years ago.



Greenhouse gas emissions lead to warming of Earth's atmosphere and ocean. This warming leads to increased melting of ice sheets and glaciers, as well as ocean expansion. As the ocean takes up more space due to warming and gains mass from formerly frozen ice, the global sea level rises. As greenhouse gas emissions continue, global sea level rises faster over time. Credit: Allie Braun, NASA JP

The global sea level has been rising since the 19th century, when modern record keeping began. And, it has been rising faster in recent years. It took 90 years (1902 – 1992) for the

global sea level to rise by around 10 cm. In just the last 30 years (1993 - 2023), that same amount of rise, around 10 cm, happened again. (Source: NASA).

Scientists measure this using satellites and coastal tide gauges. "*For over 30 years, NASA and its partners have measured sea level around the world using satellites. These satellites use an instrument called an altimeter, which measures the height of the ocean's surface. Scientists then combine this data with information from tidal gauges, or instruments near the shore that track sea level in specific places. Using this data from land and from orbit, scientists can create a global view of sea level and how it is changing."* (Source: NASA, How do we measure Sea Level)

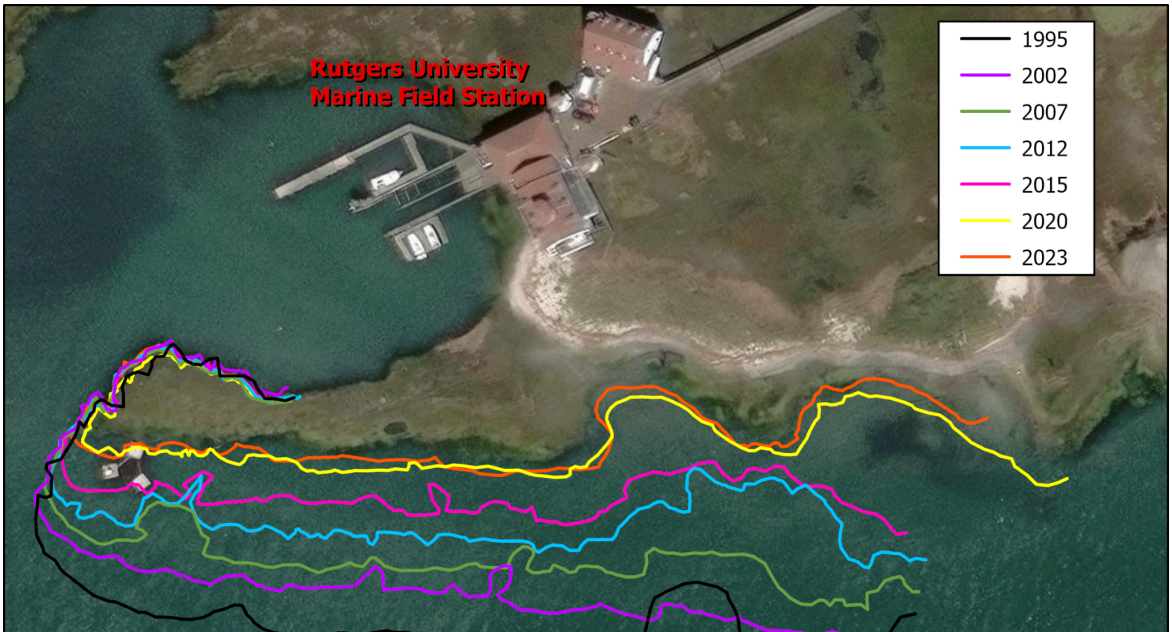
Optional: Show this brief NASA Climate Kids video about "What Causes Sea Level Rise?" which uses animations to show the causes of global SLR and how scientists use satellites and local tide gauges to measure it. Click here for more information about NASA's satellites.

New Jersey's Relationship with Sea Level Rise

- New Jersey's coast is considered especially vulnerable to sea level rise due to a combination of global ocean-level increases and local land subsidence (the sinking of land), resulting in relatively faster water level increases.
    - Additional information:
        - Sea level in Atlantic City (near Tuckerton, NJ) rose about 1.5 feet (18.0 ± 0.9 inches) from 1912 to 2021, at an average rate of 1.7 inches/decade. This compares to a global-mean rise of 0.5 feet (6.4 ± 0.9 inches) over the same period, at an average rate of 0.6 inches/decade. In other words, sea level in New Jersey rose nearly three times faster than the global average over this time period. Sources: Summary and FAQs from *New Jersey's Rising Seas and Changing Coastal Storms: Report of the 2025 Science and Technical Advisory Panel*
        - This increased rate of SLR can be attributed, in part, to how quickly land in New Jersey is sinking. Land can sink from human actions and from natural geologic changes.
            - For human actions, these changes happen over decades. For example, some towns in New Jersey get their drinking water from aquifers. An aquifer is a body of porous rock or sediment saturated with groundwater (Source: National Geographic). When water is removed from the ground, it leaves empty space behind that can be compacted by the weight of the rock and sediment around it. This compaction causes land to sink. You can think about this process like a wet sponge: the water-soaked sponge is the aquifer, when the water is removed from the sponge (squeeze sponge), the sponge shrinks and takes up less space.
            - For natural geologic changes, these changes happen over thousands of years. Land in New Jersey is sinking because a huge sheet of ice covered Canada and reached the northern

portion of New Jersey during the last ice age. The ice sheet was over 2.5 miles thick in some places! The weight of that ice caused the land under it to compress and sink, while the land around the edge of the ice sheet (e.g., New Jersey) rose in response. The ice sheet retreated at the end of the last ice age and, with that weight gone, the land around the edge of the ice sheet (e.g., New Jersey) has been slowly sinking. You can think about this process like a beanbag chair: when you (the ice sheet) sit in the beanbag chair the bag around you (New Jersey) puffs up, when you get up from the beanbag chair, the bag around you (New Jersey) sinks back to it's original level. Scientists call this process glacial isostatic adjustment or GIA (Source: The Geological Society of America).

- *Marine Field Station: The Retreat* follows Rutgers University marine scientists at their coastal research station in Tuckerton, New Jersey, where rising seas are progressively threatening the facility's mission and existence. Researchers discuss how they are simultaneously researching the effects of sea level rise, witnessing the impacts, and responding in real time.
    - The Rutgers University Marine Field Station is located on the Great Bay in New Jersey. Scientists have been recording the location of the shoreline in front of the station over the last 30 years.The shoreline, composed of sand and saltmarsh, has been disappearing over time due to climate change related impacts. The map below shows the shoreline change over time.
        - Ask students: *From 1995 to 2025, how far has the shoreline moved back/ retreated?* (Hint: Use the map scale on the bottom left of the map and compare the locations of the lines) Answer: From 1995 to 2025 (30 years), the shoreline moved back/retreated approximately 50 m (165 feet) on average. For reference, 50 m is about half the length of a high school football field! In some areas, the shoreline to the east of the field station has retreated over 80 meters (262 feet) since 1995. This is the same length as nearly 6 school buses parked end to end!



Before You Watch: Student Discussion Questions

Ask students pre-viewing prompt questions and discuss them as a class or in small groups. Sample student answers are provided in italics below each question:

1. **We have all experienced storms. Has anyone experienced flooding?**

   To help generate responses, ask students: *Have you ever witnessed flooding during a high tide or storm? Are there places that flood now that didn't before? When was the last time a storm affected your daily routines or access to roads?*

   Help students make connections from events → to patterns → to cause → to sea level rise.

   Storms and high tides are causing flooding along the New Jersey coast and in communities near tidal rivers, marshes, and wetlands more frequently than they did in the past. Climate change is causing sea levels to rise and changes in coastal storm characteristics which in turn, affects storms and flooding.

   Sources: Summary and FAQs from *New Jersey's Rising Seas and Changing Coastal Storms: Report of the 2025 Science and Technical Advisory Panel*

2. **What do you already know about sea level rise?**

   Sea Level Rise (SLR) is one of the clearest and most measurable effects of climate change. SLR means the average height of the world's oceans is increasing over time. Scientists measure this using satellites and coastal tide gauges. The two main causes for global SLR are melting of land-based ice at the poles and thermal expansion (water expands when it warms). The main cause of the warming is the increase in greenhouse gases, such as carbon dioxide (CO_2), from burning fossil fuels. However, in New Jersey, these factors have a role, but glacial isostatic adjustment or GIA (Source: The Geological Society of America) is the largest cause of SLR, followed by thermal expansion of the ocean and then melting of land ice.

   For additional informationl: Check out minute 8:20 of the video where Dr. Bob Kopp explains this for Atlantic City, NJ. Video: New Jersey's Rising Seas and Changing Coastal Storms: An Overview of the 2025 NJ STAP Report.

3. **Why might some scientists focus their work on specific locations like New Jersey's coast?**

   Scientists might focus their work in NJ because NJ is experiencing significant impacts from sea level rise. The rate of change in NJ is higher than the global average.

a. *Scientists who live in NJ might want to better understand and study the place where they live.*
b. *NJ has important coastal industries that support the state's economy. Rising sea levels could negatively impact those industries and, in turn, economic gains in NJ. Industries include: tourism, fisheries, maritime shipping/trade.*
c. *For marine scientists, there are significant advantages to being right there at the water's edge. If they retreated to a site a few miles inland, and if they docked their boats at different locations, they would lose a lot of time every day getting to and from the places they want to study. But being on the water's edge also has great risks, as we see in the film.*

4. **How can sea level rise affect people's lives? Especially people who live in coastal areas?**

   SLR causes flooding, land loss, stronger storm surges and saltwater intrusion. People may be finding it difficult to live in coastal areas where they once lived 100+ years ago because their homes and streets have flooded, or the land has disappeared. Some people tolerate the flooding but are not sure how much longer they can last. Saltwater can move into freshwater supplies and farmland, making drinking water and agriculture more difficult.

5. **What are the choices that people living in coastal areas can make about their homes when the effects of sea level rise are causing risk and potential harm?**

   When people are facing risk or harm to themselves or property resulting from the effects of SLR, they have a few choices:

   a. *Defend against the water- stay put and keep investing in property when it floods or is damaged by storm surges with no contingency plan*
   b. *Live with the water - adapt homes/communities to be more resilient to climate risks (e.g. use stilts to raise homes, raise the level of the roads, install more efficient street stormwater drains)*
   c. *Retreat from the water- Move somewhere else*
      i. *Additional discussion point: People become very attached to where they live. They're not just making calculations about risks and costs; they also LOVE their homes and places of work. This makes any discussion of retreat incredibly difficult. Even for the scientists who understand the risks so well!*

Optional Primer Activities:

NJFloodMapper: Is your school located in a coastal area? If so, find your school on NJFlood Mapper and explore different future sea level conditions. If not, find Tuckerton, NJ (the film's location), and test different future sea level conditions.

Show Video: *Marine Field Station: The Retreat* (10:54 minute run time): https://coastalhub.org/beyondtheresearch/documentaryfilms/

After You Watch: Student Discussion Questions

Ask students to respond to post-viewing prompt questions and discuss them as a class or in small groups. Sample student answers are provided in italics below each question:

1. **What surprised you while watching the film?**

   Encourage students to think about unexpected details such as:
   - *The irony of sea level rise affecting a real research site that studies sea level rise.*
   - *The scientists are not exempt from the risks of operating in a vulnerable coastal area; they discussed the possibility of losing their labs and workplaces.*
   - *The scientists are real people; they showed their emotional reactions to seeing changes firsthand and to watching a place they love degrade. They must come to terms with having to retreat and work at another location.*

2. **Do you have a place (or thing) near and dear to you that might be at risk of being changed or impacted due to the effects of climate change?**

   Students can consider: their hometown, places they have visited on vacation, local beaches, riverbanks or parks, also inland buildings or neighborhoods can be vulnerable to flooding.

3. **Do you relate to any of the feelings/emotions/values shared in the film?**
   a. **If so, how and why?**

   Scientists in the film talk not just about research but about connection to place, concern for the future, passion for what they do and the value of their work in their community. Students might reflect on feelings such as: worry or urgency, pride in doing meaningful work, sadness about loss, responsibility to act or help.

4. **What do the Rutgers Marine Field Station scientists gain, and what do they risk?**

   - *Scientists gain:*
     - *A unique firsthand view of sea level rise as it happens*
     - *Data that can help inform estimates of marsh and shoreline loss*
     - *The opportunity to model how coastal property owners react to the increasingly challenging risks they face*
   - *Scientists risk:*
     - *Losing the field station as rising waters make it less accessible and cause it damage*
     - *Personal and professional investment in a place they care about*
     - *The emotional toll of witnessing environmental change up close and dealing with the daily challenges of maintaining the station*

5. **How can the experiences of the researchers at the field station help others along the coast?**

   Their work can:

   - *Inform community planning and preparedness for rising seas*
   - *Provide real data on how environments respond to climate change*
   - *Offer models and lessons for adaptation strategies elsewhere*
   - *Help communicate how and why sea level rise could affect normal people beyond reports and data*

Wrap Up Discussion: From Awareness to Action

Start with: *"The scientists at the Rutgers University Marine Field Station are studying and living change, but they're also adapting to it. What does that tell us about how humans respond to challenges?"*

Guide students toward these takeaway messages:

- Climate change is real and affects people's lives.
- But humans are creative, adaptable, and capable of improvement and solving problems.
- Science can help people improve and prepare for future conditions.

Shift the conversation to action:

Ask: *"If knowledge is power, what power do these scientists have?"*

Possible student responses:

- *They can share their experience with communities, inspire them to understand the changes happening, and serve as a model for how to respond.*
- *They can train future scientists (maybe even people in this room).*

Then follow with: "What power do *you* have?". Students have power in their personal life, school, community and beyond (now and in the future).

Personal	School or Community	Future
Learn about how climate change affects your region.	Start or join an environmental organization (e.g. participate in citizen science with MyCoastNJ by taking photos in your	Consider careers in: Marine/climate science, Engineering, Urban planning, Public health, Policy or communications

	community)	
Talk to family about flooding risks or emergency preparedness. (e.g. *Be Tide Smart* and sign up for local flood alerts)	Advocate for recycling or energy efficiency at school (e.g. participate in National Wildlife Federation's Eco-Schools program).	Consider where you live and how SLR might affect your town now and in the future.
Reduce waste or energy use where possible.	Volunteer for a local beach, river, or park cleanup.	Reduce waste or energy use where possible.

4. End with a reflection that is hopeful and have students complete one sentence:

- “One thing I care about protecting is _____.”
- “One skill I have that could help in the future is _____.”
- “One small action I could realistically take is _____.” (pull from the table above)

5. Provide students with a final uplifting message. A draft of the concluding message is provided below but this can be customized to your geographic location, community needs, etc.

> *“Before we leave today, I want to take a few minutes to step back and think about what we just watched.*
>
> *The film shows scientists working in a place they care about deeply. It’s not just a job site or a research station. It’s a place filled with memories, long days of fieldwork, discoveries, teamwork, and connection to the coast. Similar to how many of us connect with our homes, families, friends and neighborhoods. And at the same time, it’s a place that will not look the same in the future.*
>
> *Climate change can sometimes feel abstract - numbers on a graph, degrees of warming, inches of sea level rise. But this film reminds us that climate change is also personal as it affects real places, communities and people. And yet, what stood out most is not just what might be lost, but how people respond. The scientists in the film are not ignoring what’s happening or pretending it isn’t real. Instead, they’re doing what humans do best when facing a challenge: they’re learning, adapting, measuring, building, and sharing knowledge. Climate change is a challenge; some might argue that it’s the biggest challenge our world faces today, but it’s also an opportunity for innovation in resilience and leadership. The future isn’t written yet. The choices people make, including your generation, will shape what happens next.”*

Optional Follow-up Activities:

New Jersey (NJ) Specific:

- NJ Climate Change Education Initiative: Teaching Materials and Educator Support
- NJ Department of Education Climate Education Resources: Real World Activities and Challenges
- See How High: FREE & interactive game to teach about sea level rise! https://jcnerr.org/sea-how-high/

National:

- NOAA's Sea Level Rise Module
- Coastal Studies Institute Student Activities
- The Nature Conservancy's Understanding Climate Change Lesson Plans
- NASA Sea Level Rise Resources for Educators:
    - Project: How Melting Ice Causes Sea Level Rise
    - Stability and Change: Monitoring Sea Level Student Activity
    - Student Activity: Sea Level Rise By Decade
    - Data Jigsaw Student Activity: Exploring Sea Level Rise with Others