Exercise 3: Monitor climate change indicators

How can I print an exercise to PDF format?

Technical note

For this exercise, use the latest version of one of these browsers:

- Apple Safari
- Google Chrome
- Microsoft Edge
- Mozilla Firefox

This exercise was developed using Google Chrome. If you use a different web browser, your results might be slightly different from the results that are shown.

Introduction

Climate change is a complex issue. The World Meteorological Organization (WMO) uses seven climate indicators to help understand climate change at a global scale:

1. Concentration of greenhouse gas emissions
2. Global mean temperature
3. Ocean heat content
4. Sea-level rise
5. Ocean acidification
6. Sea ice extent
7. Glacier mass balance

Anthropogenic activities, such as deforestation or burning of fossil fuels, also contribute to these climate indicators.

Scenario

For this exercise, imagine that you are researching how GIS can help identify the impacts of climate change. You will review a story created with ArcGIS StoryMaps that discusses the seven climate indicators, a dashboard created with ArcGIS Dashboards that monitors global coral-bleaching events, and a climate model that predicts future sea-level rise based on different greenhouse gas emission scenarios. All of these resources use GIS to visualize, map, and provide information about the impacts of climate change.

Note: The exercises in this course include View Result links. Click these links to confirm that your results match what is expected.

Estimated completion time in minutes: 25

Expand all steps | Collapse all steps

- **Step 1: Explore a story**

ArcGIS StoryMaps is a powerful tool for sharing stories and engaging audiences. With StoryMaps, you can create a story that integrates GIS-based maps, text, images, and other multimedia that help visualize your story.

In this step, you will review a story created by the World Meteorological Organization (WMO) to learn about key climate change topics. You will see how StoryMaps stories can effectively share information. WMO created this story to highlight the findings of its annual State of the Global Climate report in an interactive and engaging format.

a In a web browser, go to the WMO State of the Global Climate 2022 story.

b If necessary, close or accept the Consent message.

c Scroll down to read the story.

? Under Atmosphere, what topic is discussed first in the story?

- Answer
The first topic focuses on greenhouse gases.

d Continue reading the story to answer the following questions.

? Why does ocean warming matter?

- Answer
As global temperatures rise, ocean temperatures rise as well. Warming oceans are an indicator of climate change and cause coral bleaching, sea-level rise, and ocean acidification. These changes to the ocean directly affect us all.

? How are extreme weather events related to climate change?

- Answer
As climate change continues, extreme weather events will happen more frequently. Extreme weather events are becoming more severe and more frequent as a result of rising global temperatures.

? How do rising CO_2 concentrations affect the other six climate indicators?

- Answer
Rising CO_2 concentrations lead to worsening of the other six climate indicators, which leads to greater risk of high-impact events such as heat waves, flooding, and droughts.

e After you finish reading the story, close the web browser tab.

You have explored a story that used GIS-based maps, text, images, and other multimedia to visualize and share WMO's 2022 State of the Global Climate report.

- Step 2: Explore a dashboard

ArcGIS Dashboards uses interactive visual displays to present data from maps in an easy-to-read format. Dashboards can be used to help make data-driven decisions, visualize trends, monitor real-time data, and inform communities.

In this step, you will explore a dashboard that monitors coral-bleaching locations around the world. Coral bleaching is an effect of the ocean-heat-content climate indicator. The dashboard provides daily updates on the status of coral-bleaching heat stress around the world using data from the National Oceanic and Atmospheric Administration (NOAA) Coral Reef Watch program.

a In a web browser, go to the Coral Bleaching Locations item page.

b On the right, click View Dashboard.

The dashboard opens, showing the most recent data on coral reefs at risk of bleaching.

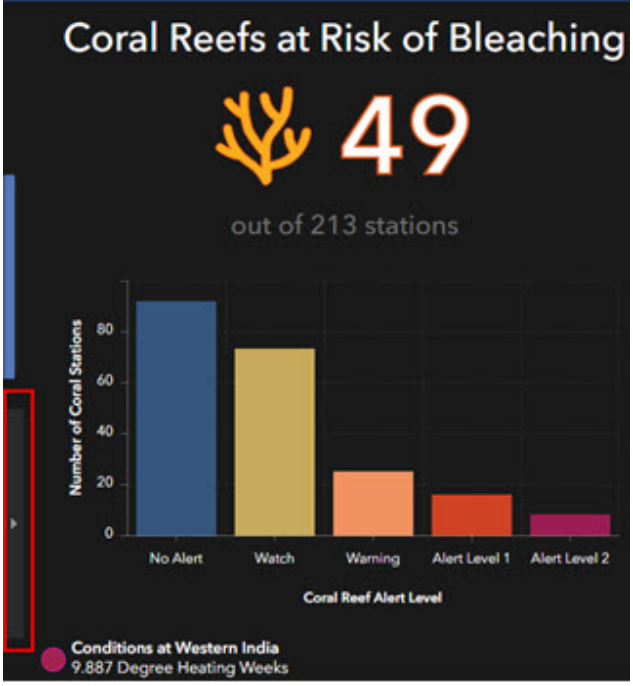
c On the left, place your mouse near the Summary.

*Step 2c***: Explore a dashboard.*

A small menu with four options appears. You can use this menu to show or hide the details element, to save the dashboard as a favorite item, to share a link to the dashboard, and to translate the page to a different language. Dashboards are made up of configurable elements, such as maps, lists, charts, gauges, indicators, and tables. You will hide the Coral Bleaching Locations details element.

d In the menu, click the More Info button to close the details element.

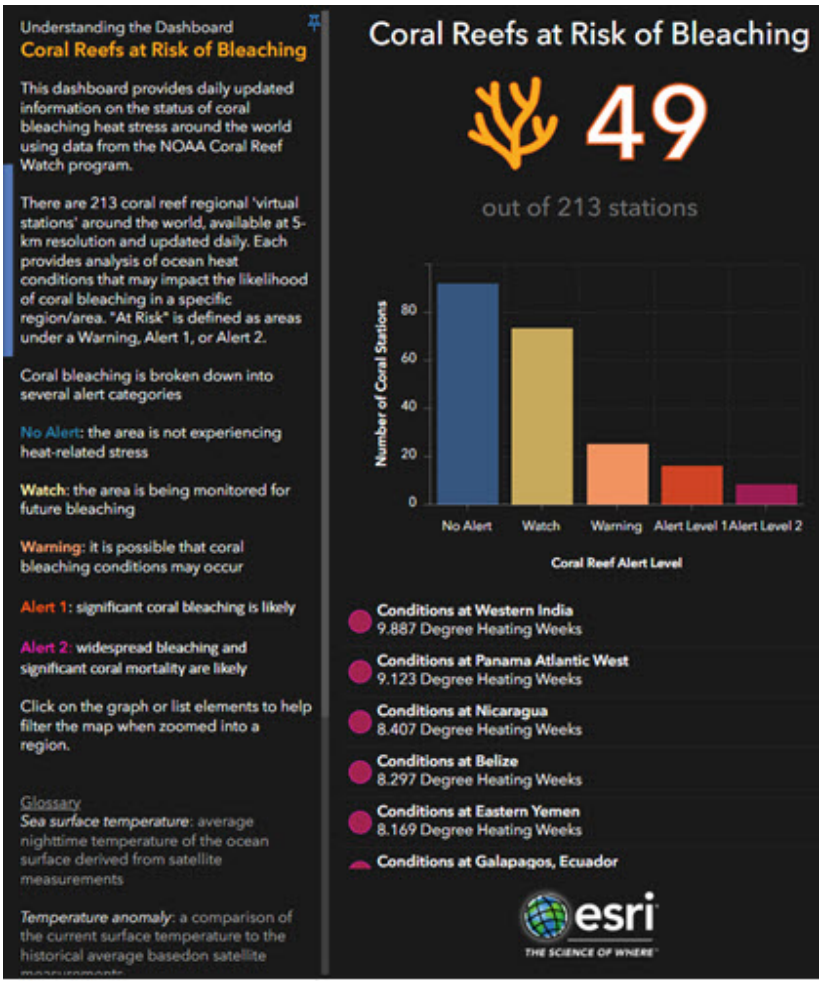
e Under the menu, click the arrow (as highlighted in the following graphic) to open the sidebar.



Note: The number of stations that you see in the dashboard may differ from this graphic because the data is updated daily.

The sidebar provides information about the alert levels shown in the dashboard. You will pin the sidebar so that you can easily refer back to this information.

f In the sidebar, next to Understanding The Dashboard, click the Pin button to pin the sidebar element.



*Step 2f***: Explore a dashboard.*

The informational sidebar is now easy to refer to as you study the dashboard.

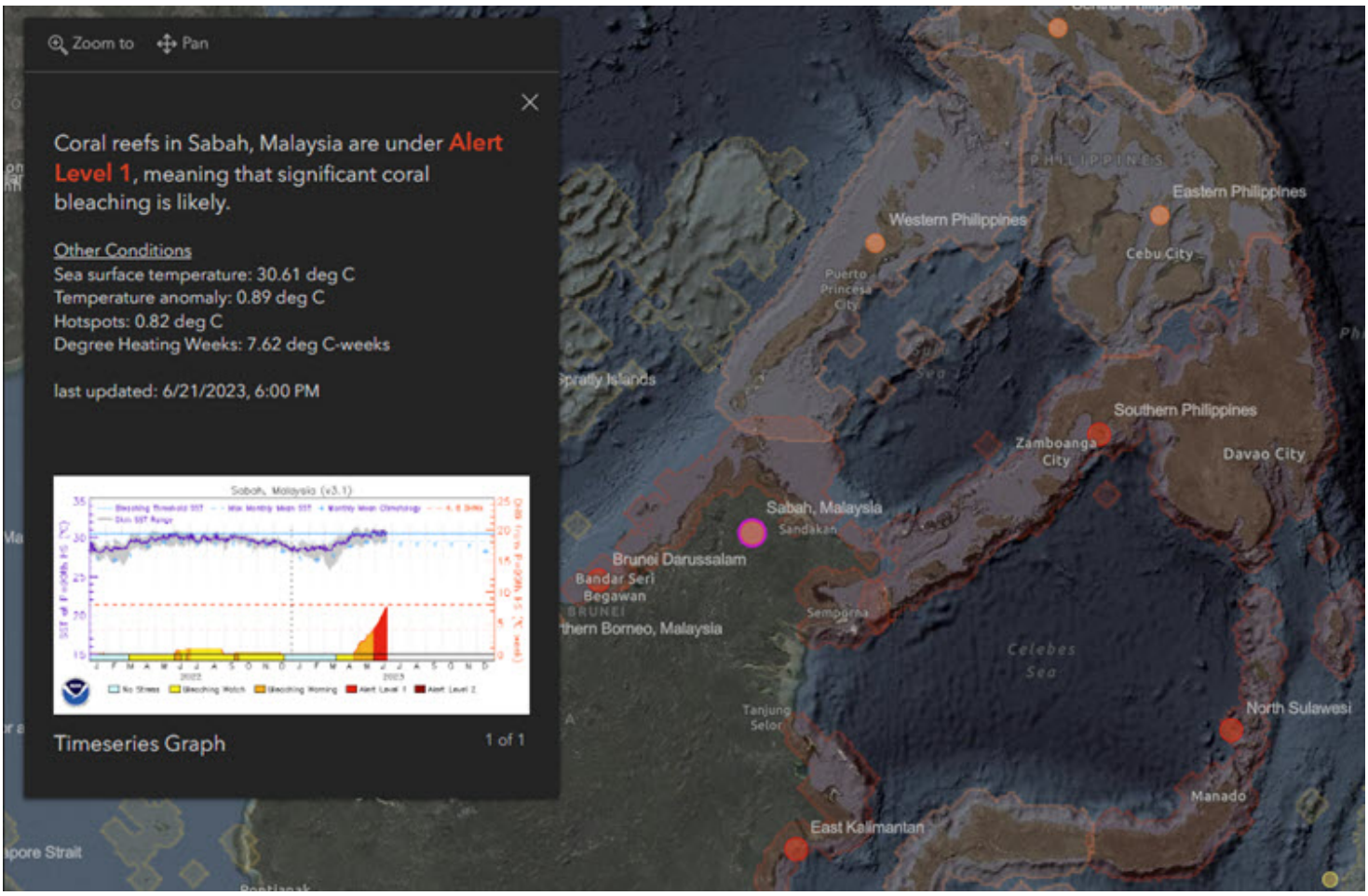
g In the bar graph, click Alert Level 1.

The list below the bar graph updates to show only locations at Alert Level 1.

h Click one of the locations in the list.

> ? What happens on the map when you click a location from the list?
>
> - Answer
> The map zooms to the selected location and flashes.

i Click the point on the map that represents the location that you selected.



*Step 2i***: Explore a dashboard.*

The contents in your pop-up window may vary depending on the location that you selected.

A pop-up window opens with more details about the location, including a time-series graph from NOAA that you can click to enlarge. The time-series graph tracks temporal changes in coral bleaching data, which allow you to see the trends or patterns in the data.

j If desired, continue to explore the dashboard.

k After you are done exploring, close the web browser tab.

You have explored a dashboard that monitors coral reefs at risk of bleaching due to warming ocean temperatures from climate change. The dashboard uses near-real-time satellite data from the NOAA Coral Reef Watch program to monitor and visualize this aspect of climate change. Like stories, dashboards help you take large amounts of data and—through GIS and data visualization—showcase the data in a way that engages the audience and helps them understand the effects of climate change.

- Step 3: Explore a climate model

ArcGIS provides app builders that help you create interactive web mapping applications, or web apps, to showcase your maps and data. Web apps are configurable applications that engage your audience and require no or low-code development.

In this step, you will explore the Sea Level Rise Viewer, a web app created by NOAA. Climate models, like the ones used in the Sea Level Rise Viewer, can help identify the risk of flooding for existing buildings and infrastructure based on projected greenhouse gas emission scenarios. The different scenarios are based on either reducing or not reducing factors that contribute to greenhouse gas emissions.

a Open a web browser tab and navigate to the Sea Level Rise Viewer.

b Read the overview, and then click Launch.

c Click Get Started.

The Sea Level Rise Viewer web app opens and focuses on the United States. NOAA sea level rise data is available for the coastlines of the United States and five territories, including Puerto Rico and American Samoa.

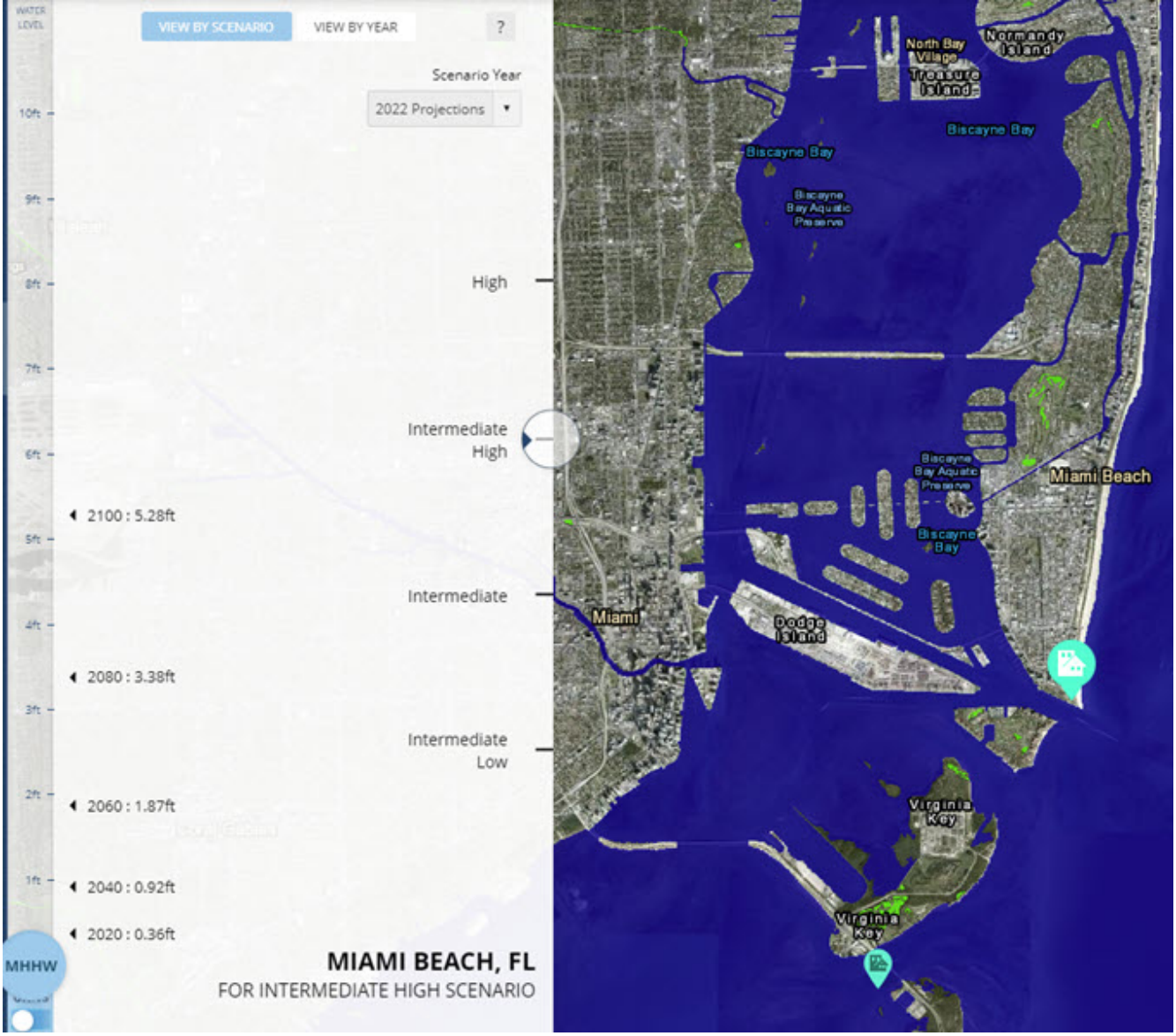
d On the left menu, click Local Scenarios.

e At the top of the page, in the Enter An Address Or City field, type **Miami Beach**.

f From the list of results, select Miami Beach, FL, USA.

The map zooms to Miami Beach, FL, which is your area of interest.

g At the southern tip of Miami Beach, click the Local Scenario icon.



*Step 3g***: Explore a climate model.*

The View By Scenario pane populates with a slider on either side: year and water depth on the left and greenhouse gas emissions scenarios on the right. By default, the Intermediate High emissions scenario is selected. Because Miami Beach is already prone to coastal flooding, you decide that the High scenario should be used for your visualization. In this model, High is the worst-case scenario and Intermediate Low is the best-case scenario.

h In the View By Scenario pane, drag the circle on the right slider from Intermediate High to High.

When you change the emissions scenario, the years stay the same but the sea-level rise changes. You will now explore when Miami Beach will experience widespread flooding due to sea-level rise. You are defining widespread flooding as inundated main streets, which would affect transportation and cause property damage throughout the city.

i Click the MHHW button and drag it upward until there is widespread flooding in Miami Beach.

Note: You can change the water level measurement from feet to meters by clicking the Units button under MHHW.

? According to the model in the High scenario, in approximately which year will Miami Beach experience widespread flooding?

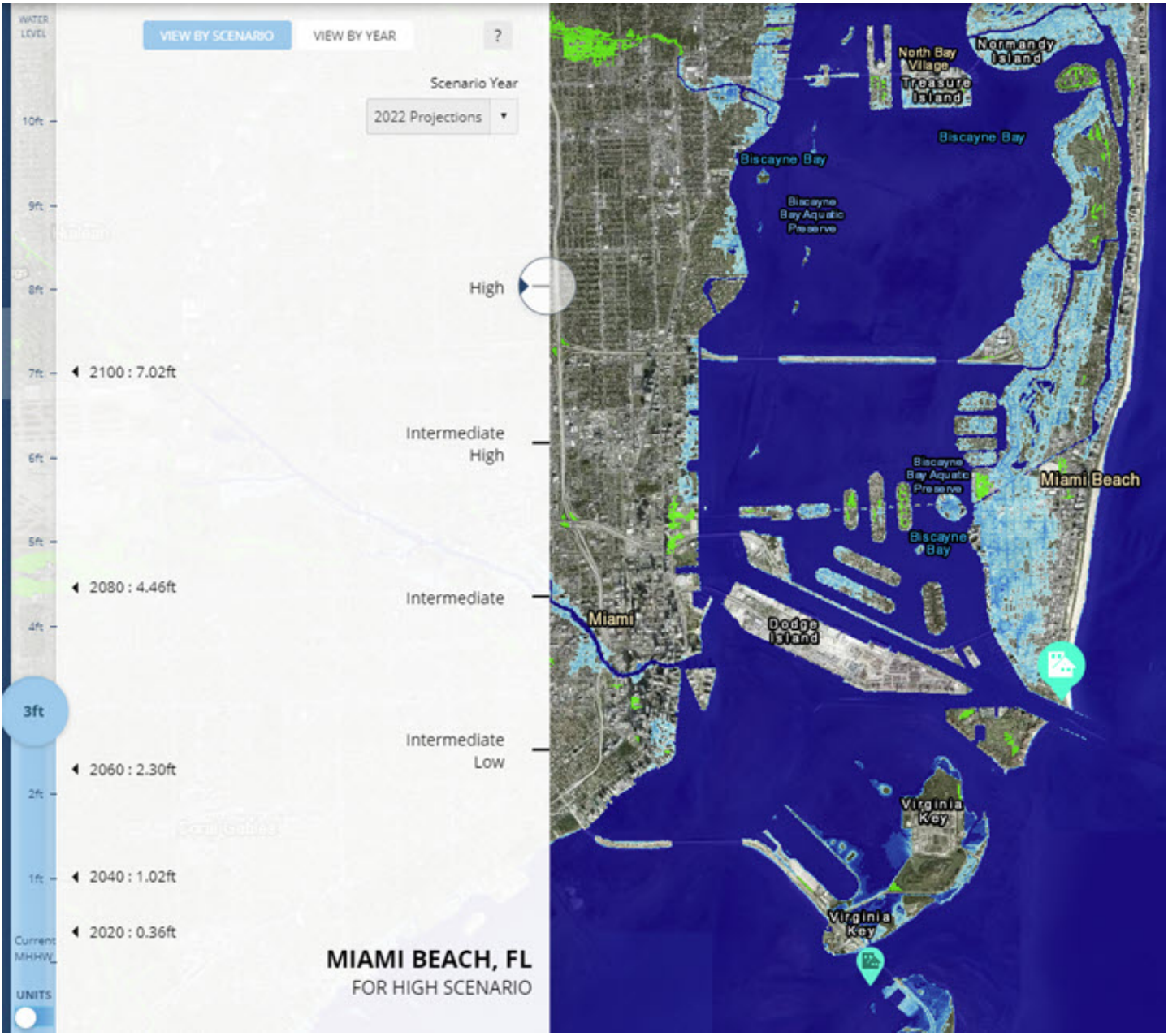
- Answer

Around the year 2065, Miami Beach will experience widespread flooding.

? Approximately how many feet (or meters) of sea-level rise will Miami Beach experience during the widespread flooding?

- Answer

In the year 2065, Miami Beach will experience about 3 feet, or 0.9 meters, of sea-level rise.



*Step 3i***: Explore a climate model.*

You explored a climate model created by NOAA that showcases the impact of sea-level rise based on greenhouse gas emissions scenarios. You used this model to identify when the city of Miami Beach could experience widespread flooding due to climate change.

j If desired, continue to explore the Sea Level Rise Viewer.

k After you finish exploring the app, close the web browser.

This exercise showcased three GIS-based applications that all focus on climate change: a story, a dashboard, and a climate-model web app.

- Step 4: Stretch goal (optional)

Throughout this course, you will be presented with optional stretch goals. These stretch goals allow you to continue or enhance the work that you completed during the exercise.

Stretch goals are community-supported, meaning that MOOC participants can use the Lesson Forum to assist one another with the steps. Stretch goals are a great opportunity to work together to learn.

This section's stretch goal is to find other examples of climate change stories, dashboards, web apps, or climate models that use GIS to visualize climate change impacts. If you have created a dashboard or story about climate change, consider sharing it with your fellow MOOC participants.

a Go to the GIS for Climate ArcGIS Hub and review the examples and applications.

b Find examples or applications that show how human actions are contributing to the warming of our climate.

c In the Lesson Forum, create a forum post titled **#StretchSection1** and share links to GIS-based web apps that focus on climate change.