Assessing Hurricane Maria damage
The browning of Puerto Rico

Hurricane Marie made landfall on Puerto Rico as a category 4 hurricane on September 20, 2017. The storm brought intense winds and rainfall that lasted for several days, damaging vegetation, pulling trees out of the ground, and blowing leaves off trees. The damage and extent of vegetation can be seen by Landsat imagery before and after the storm.

The Federal Emergency Management Agency (FEMA) is doing a post-assessment of vegetation damage caused by Hurricane Maria in Puerto Rico. The agency has asked you to compare Landsat imagery of before and after the event.

Build skills in these areas

➢ Adding Landsat 8 Imagery to a map
➢ Enabling and configuring time animation
➢ Filtering historical satellite imagery using different band combinations
  o NDVI
  o Color infrared

What you need

➢ Account required
➢ Estimated time: under 30 minutes

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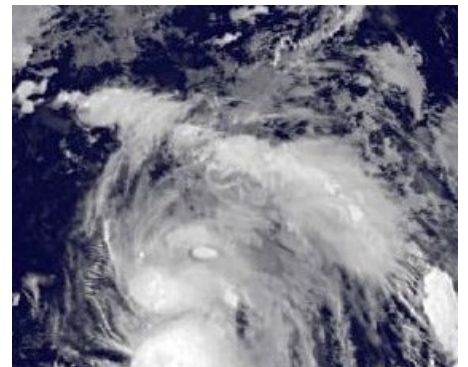
1. Create a map, add temporal multispectral data, and save

1. Sign into your ArcGIS organizational account.
2. Click Map to open the Map Viewer.
3. In the search box in the upper right of the map, search for Puerto Rico.
4. Go to Add>>Browse Living Atlas Layers.
5. Search for Multispectral Landsat.
6. Add to map as a layer.
7. Hit the back arrow to go back to the Contents Pane.
8. On the top ribbon, click Save As and add appropriate metadata.

2. Enable and configure time animation

1. In the Contents pane, point to the Multispectral Landsat layer. Click the More Options button and choose Enable Time Animation.
2. On the time animation toolbar, click the Configure button and show advanced options at the end of the Time Slider.

July 24, 1972 - July 24, 1977
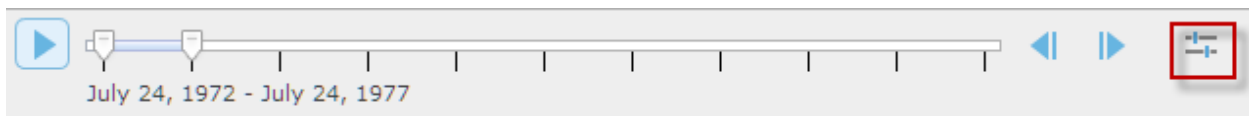
3. For Time Span, change the start time to 6/1/2017, and the end time to 10/17/2017.
4. For the Time Display, change the display interval to 1 week.

5. Click OK and play the time animation again.
6. Click the first image in the map window to open a pop-up of the image.

The acquisition date for this image was June 13, 2017, and the last image after Hurricane Maria was October 3, 2017. Next, you'll filter the multispectral layer to display only the best image from before and after Hurricane Maria landed.
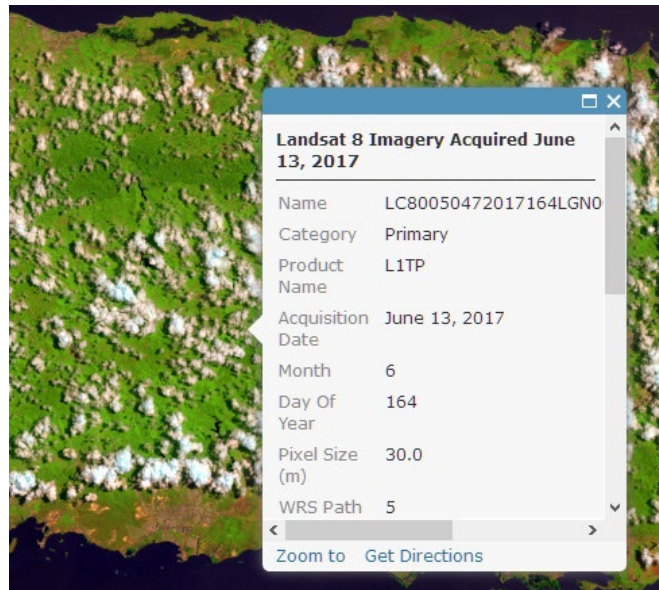
7. Click on More Options and Disable Time Animation.
8. In the Contents pane, point to the Multispectral Landsat layer and click the Filter button.
9. Delete the two expressions.
10. Configure the following expression:

Acquisition Data is on June 13, 2017.

11. Apply Filter.
12. Click on More Options and rename the layer **Before Maria**.
13. Click on More Options and copy and paste the file.
14. Rename the copied file **After Maria.**
15. Click Filter.
16. Click Edit expression.
17. Configure the following expression:

Acquisition Date is on October 3, 2017.

*Q1 What are your observations about the before and after Maria images?*

3. Change band display to NDVI and color infrared

There are two types of band combinations that are vegetation indicators. One is the normalized difference vegetation index (NDVI) with color map. The NDVI shows thick, vigorous vegetation as dark green and sparse vegetation as brown. The second band combination is near-infrared, red, green (5,4,3) with dynamic range adjustment applied on apparent reflectance. Healthy vegetation is bright red, whereas stressed vegetation is dull red.
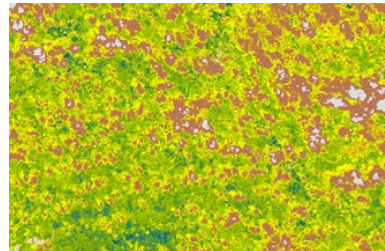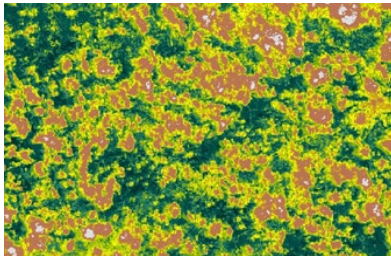
Use NDVI band combination

The NDVI shows thick vigorous vegetation as dark green and sparse vegetation as brown.

1. Click on Before Maria>>More Options>>Image Display.
    Hint: Turn off After Maria layer.
2. Under Rendered choose NDVI colorized.
3. CLOSE.

Renderer

NDVI Colorized

NDVI Colorized:

Normalized difference vegetation index (NDVI) with color map. Dark green is thick vigorous vegetation and brown represents sparse vegetation.
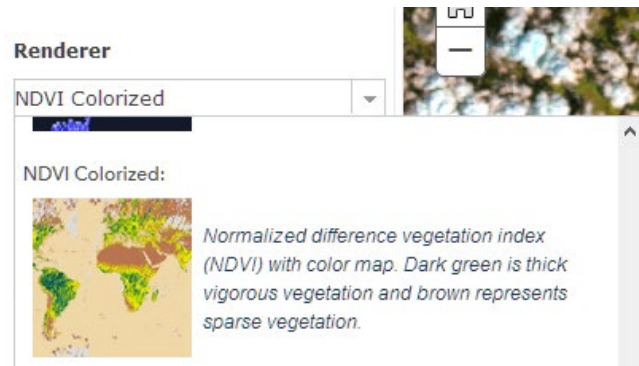
4. Repeat steps 1-3 More Options>>After Maria>>Image Display.

Q2 The NDVI shows thick, vigorous vegetation as dark green and sparse vegetation as brown. Write a comparison of the two images. Hint: Turn layers on and off to review differences between the NDVI for each.

Use color Infrared band combination

The color infrared combination consists of bands near-infrared, red, green (5,4,3) with fixed stretch applied on apparent reflectance. Healthy vegetation is bright red, whereas stressed vegetation is dull red.

1. Click on Before Maria>>More Options>>Image Display.
2. Under Rendered, choose Color Infrared.
3. CLOSE.
4. Repeat steps 1-3 for After Maria.
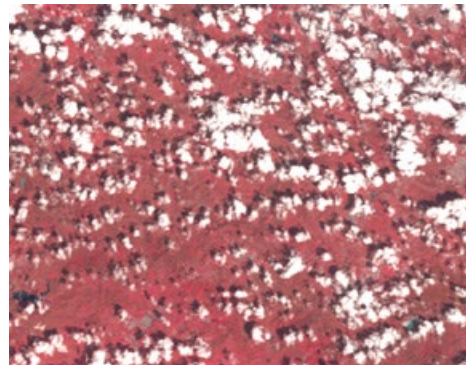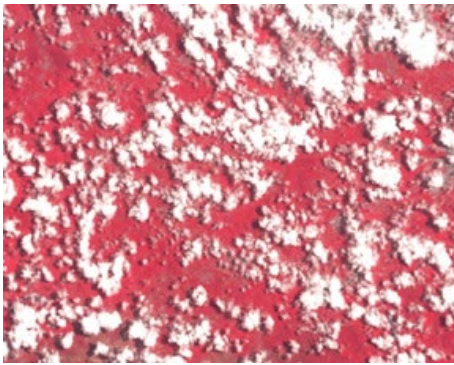
Q2 The color infrared band combination shows healthy vegetation as bright red, whereas stressed vegetation is dull red. Write a comparison of the two images.

In this lesson, you have used temporal imagery before and after Hurricane Maria to visualize the effect of the hurricane on the island of Puerto Rico vegetation.

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