QUICK START GUIDE
To Finding Data/Imagery for Student Investigations
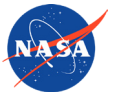
Explore Interactive Features ⊳

This table lists examples of NASA datasets and imagery that could be used for student investigations related to content and practices in the *Framework for K-12 Science Education*. Explore the data on the left using the online sources listed on the right. Many datasets are available through multiple sources; each source provides unique features, analytical tools, and time periods. Sources are color coded for relative level/ease-of-use: BLUE (introductory), ORANGE (intermediate), and GREEN (advanced).

…using these online sources of data.

Precipitation Measurement Missions — https://pmm.nasa.gov/data-access/visualization

NEO • http://neo.sci.gsfc.nasa.gov

Google Earth Engine Time Lapses — https://earthengine.google.com/timelapse

The GLOBE Program • https://www.globe.gov/globe-data

MY NASA DATA • http://mynasadata.larc.nasa.gov

Change Matters Viewer — http://www.esri.com/software/landsat-imagery/viewer

Worldview — http://worldview.earthdata.nasa.gov

Data examples that *students* can use… / Data examples that *educators* can use…	…to investigate these types of phenomena… / …to make connections to K–12 content and practices…	PMM	NEO	Google EE	GLOBE	MND	Change Matters	Worldview
Aerosols: Tiny liquid or solid particles dispersed in the atmosphere; can be caused by natural processes or human activity.	Air quality and pollution (ESS3.C) / Earth's energy budget (ESS2.A) / Weather & climate (ESS2.D)		●		●	●		●
Black Marble/Earth at Night: Nighttime view of Earth, showing visible light emanating from man-made sources, e.g., city lights.	Urban growth/heat Islands (ESS3.C) / Power outages (ESS3.C) / Seasonal migration (LS2.C)				●			●
Blue Marble Next Generation: Composite images showing how the surface would look to a human in space if our world had no clouds and no atmosphere.	Seasonal changes on land surface (spring greening, snowmelt, drought, etc.) (LS2.A, ESS2.D)		●					●
Climate: Solar Insolation, temperature, precipitation, albedo, greenhouse gases/carbon, aerosols, and topography.	Factors contributing to global and regional climate (ESS2.D)		●		●	●		●
Earth System: Solar insolation, surface temperature, cloud fraction, aerosols, precipitation, and vegetation index.	Earth system and cycles (ESS2.A)	●	●		●	●	●	●
Land Cover Classification: Maps displaying the Earth's natural and human-made landscapes as color-coded categories.	Land cover changes (ESS3.C, LS2.C)		●		●	●	●	
Land Surface: Since 1972, **Landsat** satellites have been observing Earth's land surfaces and coastal regions. **MODIS Near-Real-Time Data:** Data for applications related to natural hazards and disasters (e.g., volcano ash plumes, drought, fires, severe storms, and sea ice conditions).	Coastline changes (ESS2.C) / Deforestation (ESS3.C) / Ecosystems (LS2.C) / Natural hazards & disasters (ESS3.B) / Sea ice movement (ESS3.B) / Water & land use changes (ESS2.C)			●			●	●

← **INTRODUCTORY** → — PMM • NEO • Google EE
← **INTERMEDIATE** → — GLOBE • MND
← **ADVANCED** → — Change Matters • Worldview

Data examples that *students* can use…

Data examples that *educators* can use…

…using these online sources of data.

Data examples	…to investigate these types of phenomena… / …to make connections to K–12 content and practices…	Precipitation Measurement Missions (PMM)	NEO	Google Earth Engine Time Lapses	The GLOBE Program	MY NASA DATA (MND)	Change Matters Viewer	Worldview
Land Surface Temperature: Temperature of what is on the land surface (e.g., snow and ice, grass, roads), which is different from air temperature. Land temperature anomaly maps show higher or lower than average temperatures.	Global warming (ESS3.D) / Urban heat islands (ESS3.C) / Weather/seasons (ESS2.D)		●		●	●		●
Precipitation: Global and regional rain and snow accumulation.	Natural hazards and disasters (floods, landslides, severe storms) (ESS3.B) / Water cycle and resources (ESS2.C) / Weather and climate (ESS2.D)	●	●		●	●		●
Radiation and Energy: Albedo—relative amount of incoming radiation reflected up; Solar insolation—amount of Sun's energy that reaches the surface; Solar radiation—amount of sunlight reflected by Earth's surface, clouds, & atmosphere (shortwave) or absorbed then emitted by Earth's surface, water vapor, gasses, and aerosols (longwave).	Earth's energy budget (PS3.D) / Electromagnetic spectrum (PS4.B) / Plant growth patterns (LS2.C) / Solar power (ESS2.A, PS3.D) / Weather and climate patterns (ESS2.D)		●		●	●		●
Sea Ice: Sea ice changes the normally dark blue ocean into solid white ice. This affects weather and climate—sunlight that would be absorbed by the ocean is now reflected back by the ice, due to its high albedo.	Earth system and feedback loops (ESS2.A) / Electromagnetic radiation (PS4.B)		●			●		●
Sea Surface Temperature: Temperature of the very top layer of the ocean and other large bodies of water.	Carbon cycle/carbon in ocean (PS3.D) / El Niño (ESS2C, ESS2.D) / Hurricanes and typhoons (ESS3.B) / Marine ecosystem health (LS2.A) / Ocean circulation and climate (ESS2.C)		●		●	●		●
Vegetation and Leaf Area Indices: Measure of the "greenness" of Earth's landscapes—where and how much green leaf vegetation was growing during a time period.	Deforestation (ESS3.C, LS2.C) / Forest and crop health (LS2.C) / Plant growth patterns (LS2.C) / Seasonal changes (green up/down) (LS2.A)		●		●	●	●	●
Weather: Atmospheric temperature, pressure, radiation, and water vapor, precipitation.	Weather and climate (ESS2.D)	●	●		●	●		●

Online sources of data (links):
- Precipitation Measurement Missions — https://pmm.nasa.gov/data-access/visualization
- NEO — http://neo.sci.gsfc.nasa.gov
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- MY NASA DATA — http://mynasadata.larc.nasa.gov
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NASA

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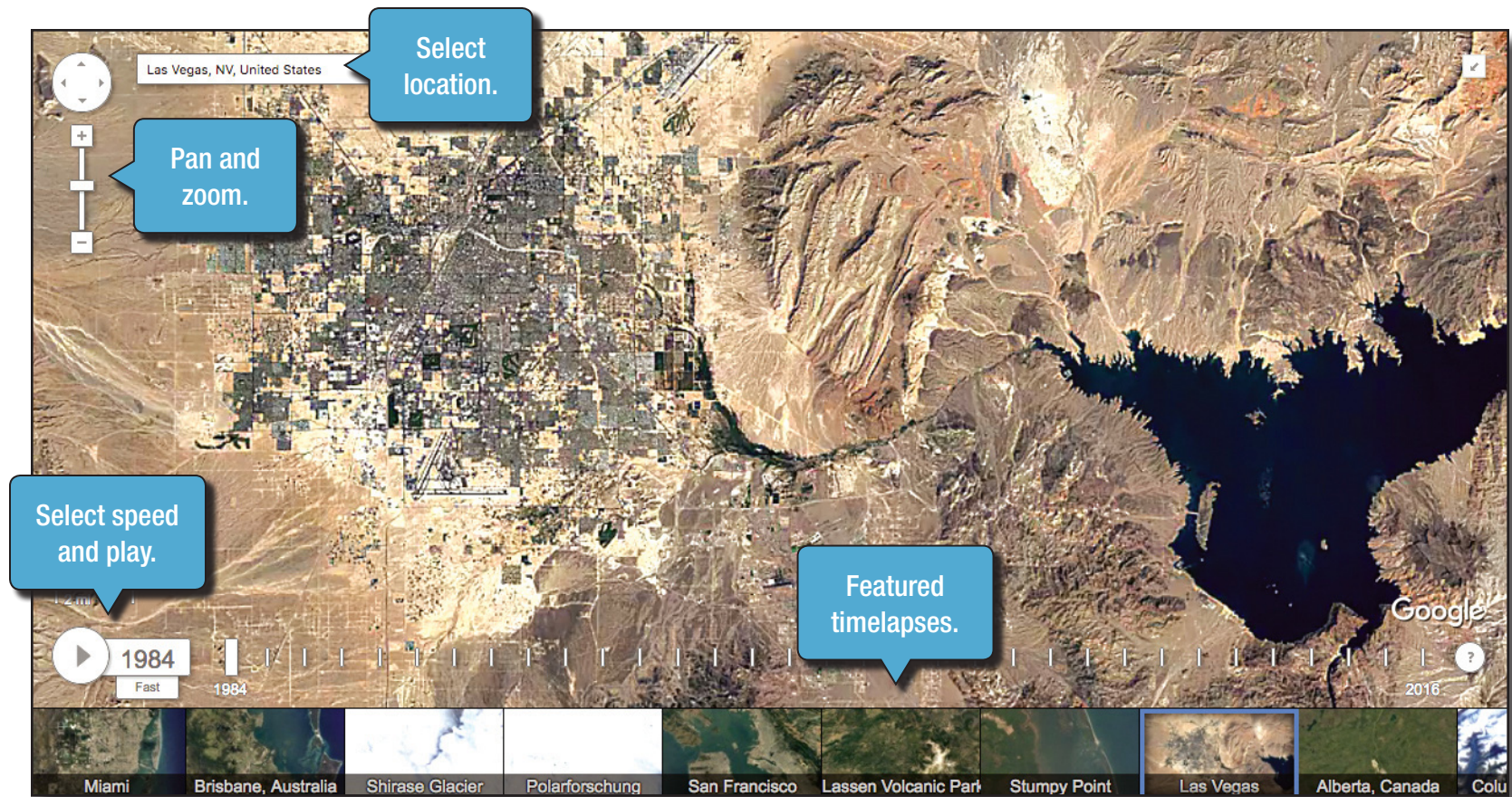
1) Click on URL to go to online resource.

Data examples that

2) Click on topic to explore background resources and additional information (e.g., Aerosols).

…to investigate these types of phenomena…

…to make connections to K–12 content and practices…

…using these online sources of data.

Precipitation Measurement Missions
https://pmm.nasa.gov/data-access/visualization

NEO • http://neo.sci.gsfc.nasa.gov

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Change Matters Viewer
http://www.esri.com/software/landsat-imagery/viewer

Worldview
http://worldview.earthdata.nasa.gov

3) Mouseover NGSS code for K–12 content topic (e.g., LS2.C: Ecosystem Dynamics, Functioning, and Resilience.)

4) Click on a 'bullet' to go to data resources for this topic.

5) Click to learn more about the key features of online data sources.

Data examples that	…to make connections to K–12 content and practices…	PMM	NEO	Google EE	GLOBE	MND	Change Matters	Worldview
Aerosols: Tiny liquid or solid particles dispersed in the atmosphere; can be caused by natural processes or human activity.	Air quality and pollution (ESS3.C) Earth's energy budget (ESS2.A) Weather & climate (ESS2.D)		●		●	●		●
Black Marble/Earth at Night: Nighttime view of Earth, showing visible light emanating from man-made sources, e.g., city lights.	Urban growth/heat Islands (ESS3[...]) Power outages (ESS3.C) Seasonal migration (LS2.C)		●					●
Blue Marble Next Generation: Composite images showing how the surface would look to a human in space if our world had no clouds and no atmosphere.	Seasonal changes on land surfac[...] (spring greening, snowmelt, drou[...] (LS2.A, ESS2.D)							●
Climate: Solar Insolation, temperature, precipitation, albedo, greenhouse gases/carbon, aerosols, and topography.	Factors contributing to global and regional climate (ESS2.D)		●		●			●
Earth System: Solar insolation, surface temperature, cloud fraction, aerosols, precipitation, and vegetation index.	Earth system and cycles (ESS2.A)	●	●				●	●
Land Cover Classification: Maps displaying the Earth's natural and human-made landscapes as color-coded categories.	Land cover changes (ESS3.C, LS2.C)		●		●	●	●	
Land Surface: Since 1972, **Landsat** satellites have been observing Earth's land surfaces and coastal regions. **MODIS Near-Real-Time Data:** Data for applications related to natural hazards and disasters (e.g., volcano ash plumes, drought, fires, severe storms, and sea ice conditions).	Coastline changes (ESS2.C) Deforestation (ESS3.C) Ecosystems (LS2.C) Natural hazards & disasters (ESS3.B) Sea ice movement (ESS3.B) Water & land use changes (ESS2.C)			●			●	●

← **INTRODUCTORY** →
PMM • **NEO** • **Google EE**

← **INTERMEDIATE** →
GLOBE • **MND**

← **ADVANCED** →
Change Matters • **Worldview**

Online Resources: KEY FEATURES

Explore key features of online Earth science data tools that can be useful for K–12 student investigations. Sources are color coded for relative level/ease-of-use: BLUE (introductory); ORANGE (intermediate) and GREEN (advanced).

Select location.

Pan and zoom.

Select speed and play.

Featured timelapses.

Las Vegas, NV, United States

1984 Fast

1984   2016

Miami | Brisbane, Australia | Shirase Glacier | Polarforschung | San Francisco | Lassen Volcanic Park | Stumpy Point | Las Vegas | Alberta, Canada | Colu

Google Earth Engine: Time Lapses

https://earthengine.google.com/timelapse

Global, zoomable video that lets you see how the Earth has changed over the past 32 years. The majority of the images come from Landsat, a joint USGS/NASA program.

INTRODUCTORY Source

Return to Quick Start Guide

IMAGE CREDIT: Las Vegas and Lake Mead, Landsat, USGS/NASA.

Online Resources: KEY FEATURES

Precipitation Accumulation - 01 Jun 2017 0500 UTC - 24 Hours

| 8 0.33 | 17 0.66 | 25 1 | 34 1.33 | 42 1.66 | 51 2 | 64 2.50 | 76 3 | 102 4 | 127 5 | 178 7 | 229 9 | 279 11 | millimeters inches |

View last 30 min, 24 hours, or 7 days.

Color key (inches & mm).

Easy navigation.

Zoom, drag and turn globe with touchpad or mouse.

Precipitation Measurement Missions

http://bit.ly/Precipitation

Data visualization tools for viewing near-real-time, global precipitation data, and flood and landslide nowcasts. Includes links to download data.

IMAGE CREDIT: Precipitation accumulation, May 3, 2017, Global Precipitation Measurement (GPM) mission.

INTRODUCTORY Source

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IGES, 2017 • *http://k12datapaths.strategies.org*

Online Resources: KEY FEATURES

Browse datasets by broad category.

NEO — NASA EARTH OBSERVATIONS

ATMOSPHERE   ENERGY   LAND   LIFE   OCEAN   NEWS   ABOUT   0 IMAGES   ANALYZE

LAND SURFACE TEMPERATURE ANOMALY [DAY] (1 MONTH)

ADD TO ANALYSIS

Zoom, analyze, and compare up to 3 datasets.

Currently viewing:
February 2017
Permalink

Downloads ⓘ

File Type: JPEG

● Color ○ Grayscale

1.0 degrees   360 x 180 ▸
0.5 degrees   720 x 360 ▸
0.25 degrees   1440 x 720 ▸
0.1 degrees   3600 x 1800 ▸

Download different file formats and resolutions (CSV, PNG, Google Earth, GeoTIFF).

View by date: 1 day   8 day   **1 mo**

°C
-12   0   12
Download color table ⓘ

Dataset you are currently viewing: February 2017   Select Year 2017

2017   March 2017   April 2017   July 2017

● Data   ● No Data   ● Currently Viewing

About this dataset: 3 levels provided— Basic, Intermediate, Advanced.

Wh...
Thes... temp... day,... aver... betw... warm... that... places that are cooler than average are blue. Black means there is no data.

Related Websites
MODIS
Terra
MODIS Land Group

About this dataset   **Basic** Intermediate Advanced

12.00 °C
Lat=40.1 Lon=-101.7

■ INTRODUCTORY Source

◀ *Return to Quick Start Guide*

NASA Earth Observations (NEO)
https://neo.sci.gsfc.nasa.gov

Browse, download and explore imagery of NASA satellite data for over 50 global datasets—related to atmosphere, energy, land, life, and ocean.

START HERE:
NEO Analysis in 10 Easy Steps:
bit.ly/NEO_Analysis

IMAGE CREDIT: Monthly Land Surface Temperature Anomaly, February 2017, Images by Jesse Allen, NASA's Earth Observatory, using data courtesy of the MODIS Land Group.

Online Resources: KEY FEATURES

Select date.

Choose base map, including satellite data.

Share filters to create a URL to the data map created.

Add up to 5 data layers.

Filter by location & elevation.

Click individual data icon to display & download data for a site.

Click legend for key to data icon values.

The GLOBE Program: Visualization System & Advanced Data Access Tool (ADAT)

https://www.globe.gov/globe-data/ visualize-and-retrieve-data

IGES, 2017 • *http://k12datapaths.strategies.org*

International GLOBE schools and citizen scientists collect environmental data related to the atmosphere, biosphere, hydrosphere, and soils. Use the visualization system to locate and visualize GLOBE data, with maps, graphs, and data tables.

Start with tutorial at the URL on the left.

Use the ADAT to find, retrieve, and dowload the data into a csv file for detailed analysis—***https://www.globe.gov/globe-data/retrieve-data***

INTERMEDIATE Source

IMAGE CREDIT: Cloud cover observations by GLOBE Schools and GLOBE Observer citizen scientists on April 21, 2017.

Online Resources: KEY FEATURES

(1) Select Datasets by Sphere.

(3) Update Plot.

(4) Further exploration: Select more than 1 plot for comparison and data analysis (up to 4 plots).

Select **line plot** to see change over time.

(2) Select Date.

Data Set	Update Plot	<
One Plot	Annotations
Plot Options	ESGF Search

Correlation Viewer | Google Earth | Show Values | Export to Desktop Application | Save As...

Temperature ⓘ
Sea Surface Temperature (GHRSST) (Celsius)

TIME : 01-JAN-2016 00:00
OPeNDAP URL: http://mynasadata.larc.nasa.gov/thredds/dodsC/avhrr_sst_agg

• Subsampled 4 in X, 4 in Y

LAS 8.6/Ferret 6.95 NOAA/PMEL

Daily Sea Surface Temperature (GHRSST) | Date/Time: 2016 | Jan | 01

◉ Latitude-Longitude
Line Plots

MY NASA DATA: Earth System Data Explorer

https://mynasadata.larc.nasa.gov/EarthSystemLAS/UI.vm

Browse, download, print and explore NASA satellite data available for Earth system's spheres: atmosphere, biosphere, hydrosphere, and pedosphere (soils). **Overview** of the datasets and time periods covered:

https://mynasadata.larc.nasa.gov/live-access-server

■ INTERMEDIATE Source

IMAGE CREDIT: Daily Sea Surface Temperature, Group for High Resolution Sea Surface Temperature (GHRSST), Jan. 1, 2016.

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Online Resources: KEY FEATURES

Download data and find images of recent events (e.g., severe storms, volcanoes, fires).

Additional tools: create a URL, switch projection, and take a snapshot of your image to download (JPEG, PNG, or GeoTIFF).

Browse and choose imagery to display.

Add image layers to explore correlations.

Click the "eye" icon to show/hide layers.

Drag timeline to see past imagery or to animate the timescale.

NASA Worldview

https://worldview.earthdata. nasa.gov

Interactively browse global, full-resolution satellite imagery and download the underlying data. Most of the 400+ available products are updated within three hours of observation, essentially showing the entire Earth as it looks "right now."

This supports time-critical application areas such as wildfire management, air quality measurements, and flood monitoring. Arctic and Antarctic views of several products are also available for a "full globe" perspective. Browsing on tablet and smartphone devices is generally supported.

ADVANCED Source

IMAGE CREDIT: Corrected reflectance (true color), May, 31, 2017, Terra/MODIS.

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Online Resources: KEY FEATURES

(2) Select an image type.

(3) Select dates of interest.

(1) Enter a location.

(5) Click 'Full Screen' to launch a new window with enhanced options.

(4) Zoom in and out.

Change Matters

http://www.esri.com/software/landsat-imagery/viewer

Compare change over time using Landsat imagery from six Landsat missions beginning in 1972 to 2010.

The first two panels show a region for the selected years with the selected image type (e.g., this infrared image shows different life forms of vegetation, which are shown in shades of red). The third image shows changes in vegetation (green=increase, pink=decrease).

▮ **ADVANCED Source**

Image credit: Landsat Infrared images of New York City, 1990 and 2010 (NASA/USGS) shown in ESRI's Change Matters Viewer.
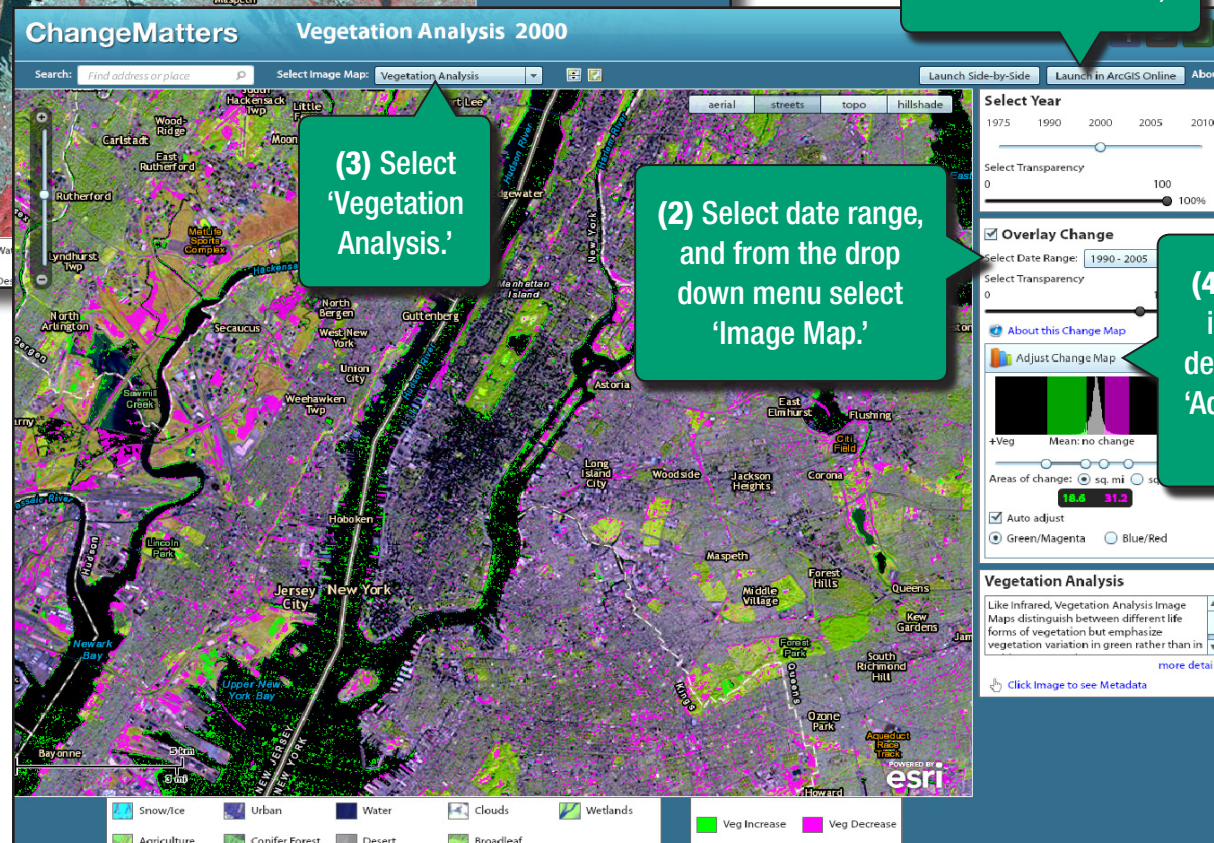
Continue to next page ➤

ChangeMatters Infrared
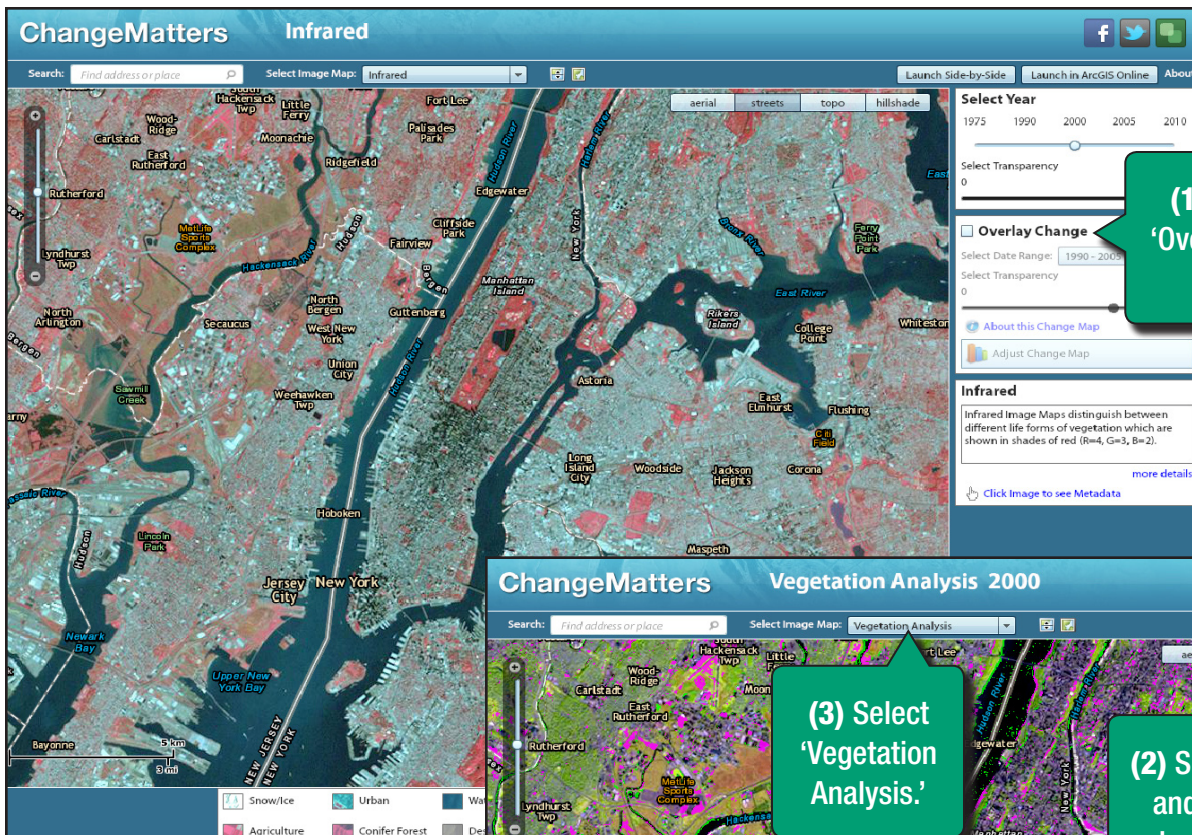
(1) Check the 'Overlay Change' box.

(5) Click 'Launch in ArcGIS Online' (limited options without an account).

ChangeMatters Vegetation Analysis 2000

(3) Select 'Vegetation Analysis.'

(2) Select date range, and from the drop down menu select 'Image Map.'

(4) To see the increase or decrease, click 'Adjust Change Map.'

Change Matters:
Advanced Features

Full Screen launches
additional options.

*Continue to
next page*

Change Matters Launched in ArcGIS Online

(7) Search for: Layers, Landsat 8. Click 'Add' and when finished adding layers, select 'Done Adding Layers.'

(6) Add additional imagery (including latest Landsat-8) in ArcGIS Online, click 'Modify Map' at the top right, select 'Add' from the drop down menu.

(8) Check or uncheck the visible layers. The top layer is the current view.

(9) Zoom in and out.

(10) Explore timelapses of the available imagery.

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ArcGIS

Modify Map   Sign In

Details   Add   Basemap   Save

About   Content   Legend

Contents

☑ Healthy Vegetation (451) 1990-2010 (Mature Support)

☐ Landsat 8 Imagery: Natural Color with DRA

☐ Landsat 8 Imagery: NDVI Colorized

Multispectral Landsat

☐ Landsat 8 Views

▸ Topographic

NYC OpenData, State of New Jersey, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS | United States Geologica...

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