



How to use GIS in your K-12 Classrooms

by Jennifer Lentz, Ph.D.

Education Specialist at the Aquarium of the Pacific

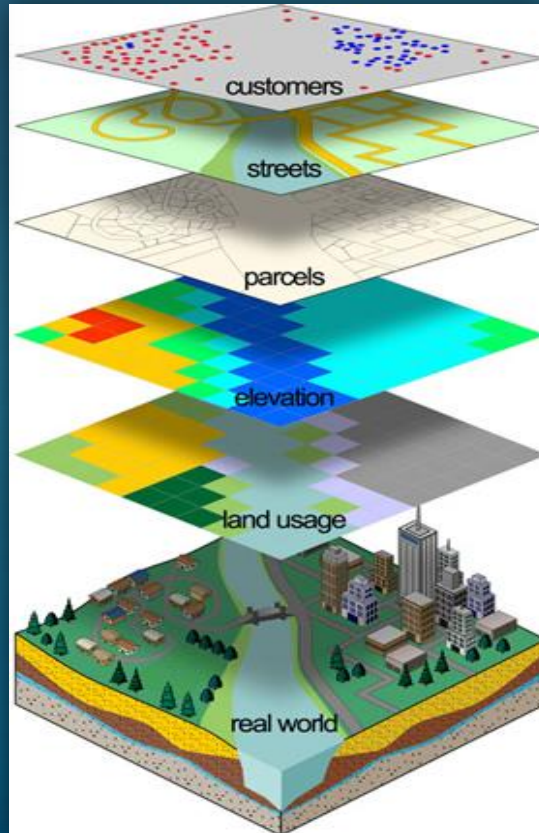
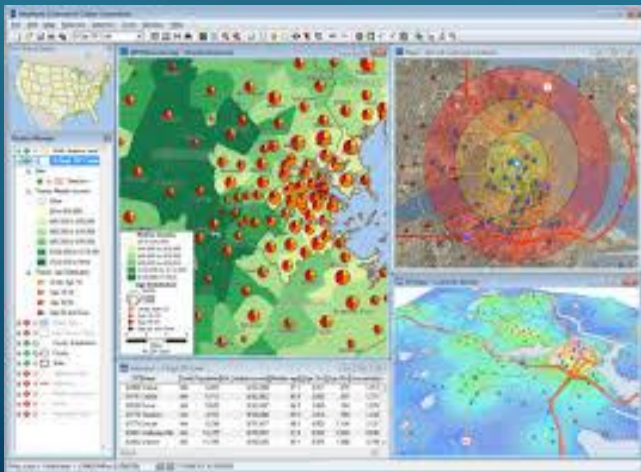
Boeing Teacher Institute (BTI) Presentation

August 3, 2015

Geographic Information Systems



Spatial Analysis

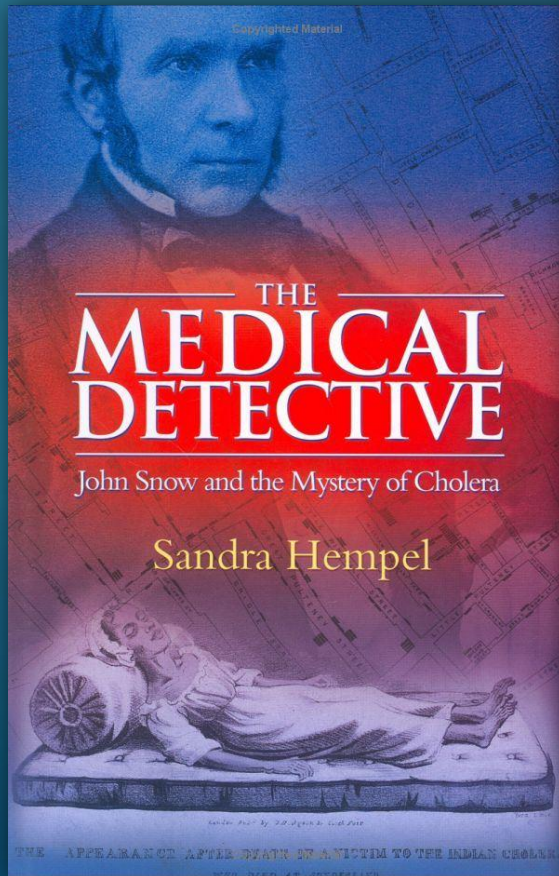


Remote Sensing



Dr. John Snow (1813-1858)

“Father of **Modern Epidemiology**”



ST. JAMES, WESTMINSTER.

The GOVERNORS and DIRECTORS of the POOR
HEREBY GIVE NOTICE,
That, with the view of affording prompt and Gratuious assistance to Poor Persons resident in this Parish, affected with Bowel Complaints and

CHOLERA,

The following Medical Gentlemen are appointed, either of whom may be immediately applied to for Medicine and Attendance, on the occurrence of those Complaints, viz.—

Mr. FRENCH, 41, Gt. Marlborough St.
(Shrop, Bow's Court, Marshall Street)
Mr. HOUSLEY, 28, Broad Street.
Mr. WILSON, 16, Great Ryder St.
Mr. JAMES, - 49, Princes Street.
Mr. DAVIES, 25, Brewer Street.

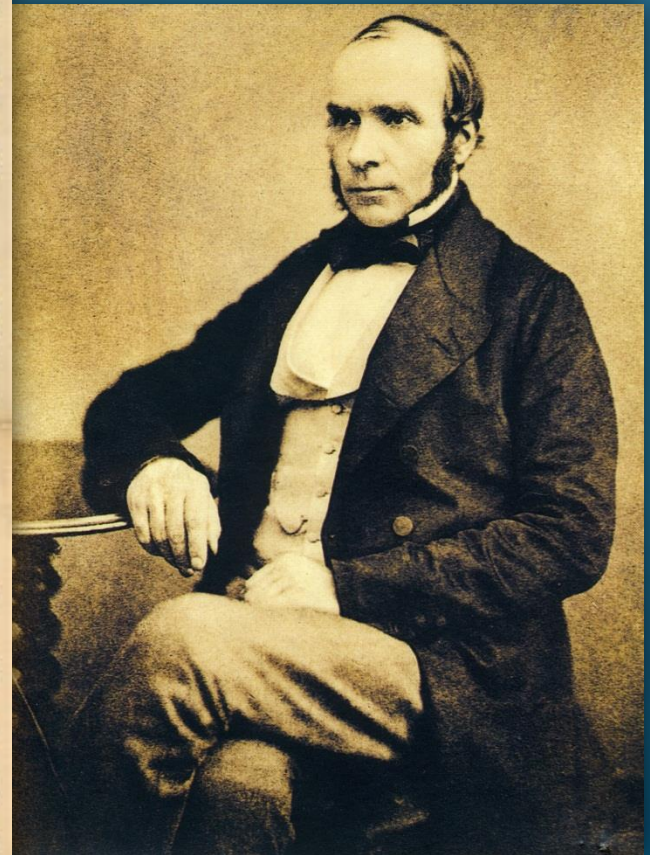
SUGGESTIONS AS TO FOOD, CLOTHING, &c.

Regularity in the Hours of taking Meals, which should consist of any description of wholesome Food, with the moderate use of sound Beer.
Abstinence from Spirituous Liquors.
Warm Clothing and Cleanliness of Person.
The avoidance of unnecessary exposure to Cold and Wet, and the wearing of Damp Clothes, or Wet Shoes.
Regularity in obtaining sufficient Rest and Sleep.
Cleanliness of Rooms, which should be aired by opening the Windows in the middle of each day.

By Order of the Board,
GEORGE BUZZARD,
FRANCIS OFFICE, Palace Street,
10th November, 1831. Clerk.

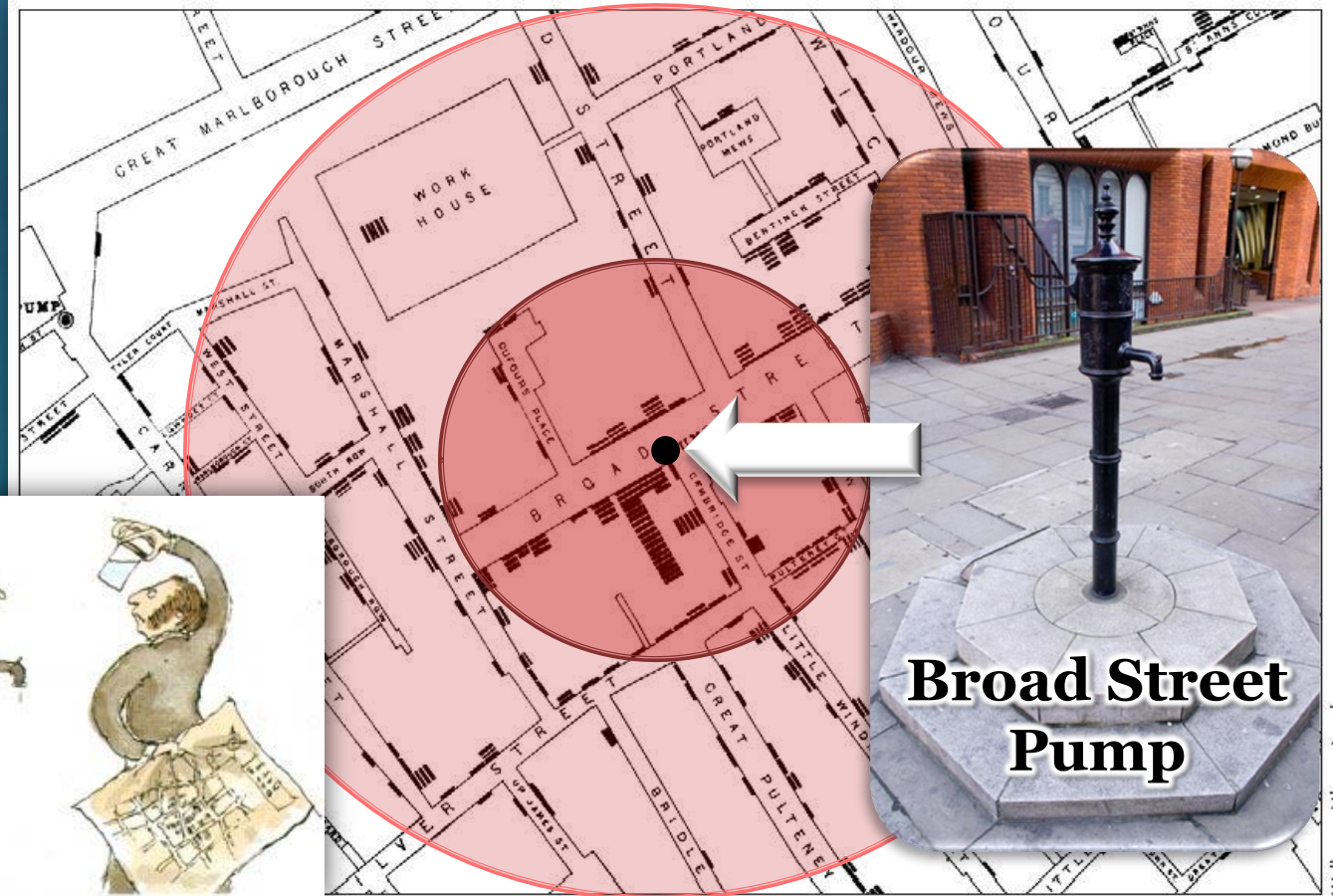
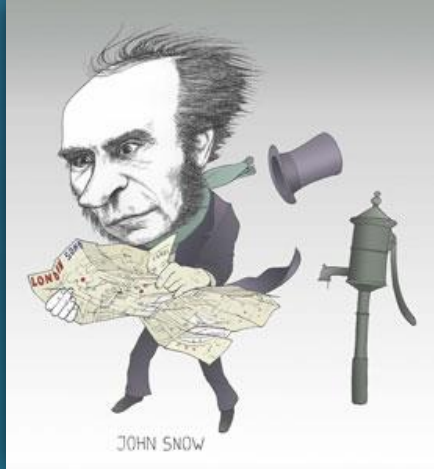
It is requested that this Paper be taken care of, and placed where it can be easily referred to.

J. BURNARD, PRINTER, 5, BRISTOL STREET, HOLBORN, LONDON.



Dr. John Snow (1813-1858)

“Father of **Medical Geography**”



Broad Street Pump

Street map of cholera deaths in Soho in 1853 from John Snow's *On the Mode of Communication of Cholera*

Modern GIS Applications

Crime Analysis



Medical Geography & Spatial Epidemiology



Ecologic & Climate Science



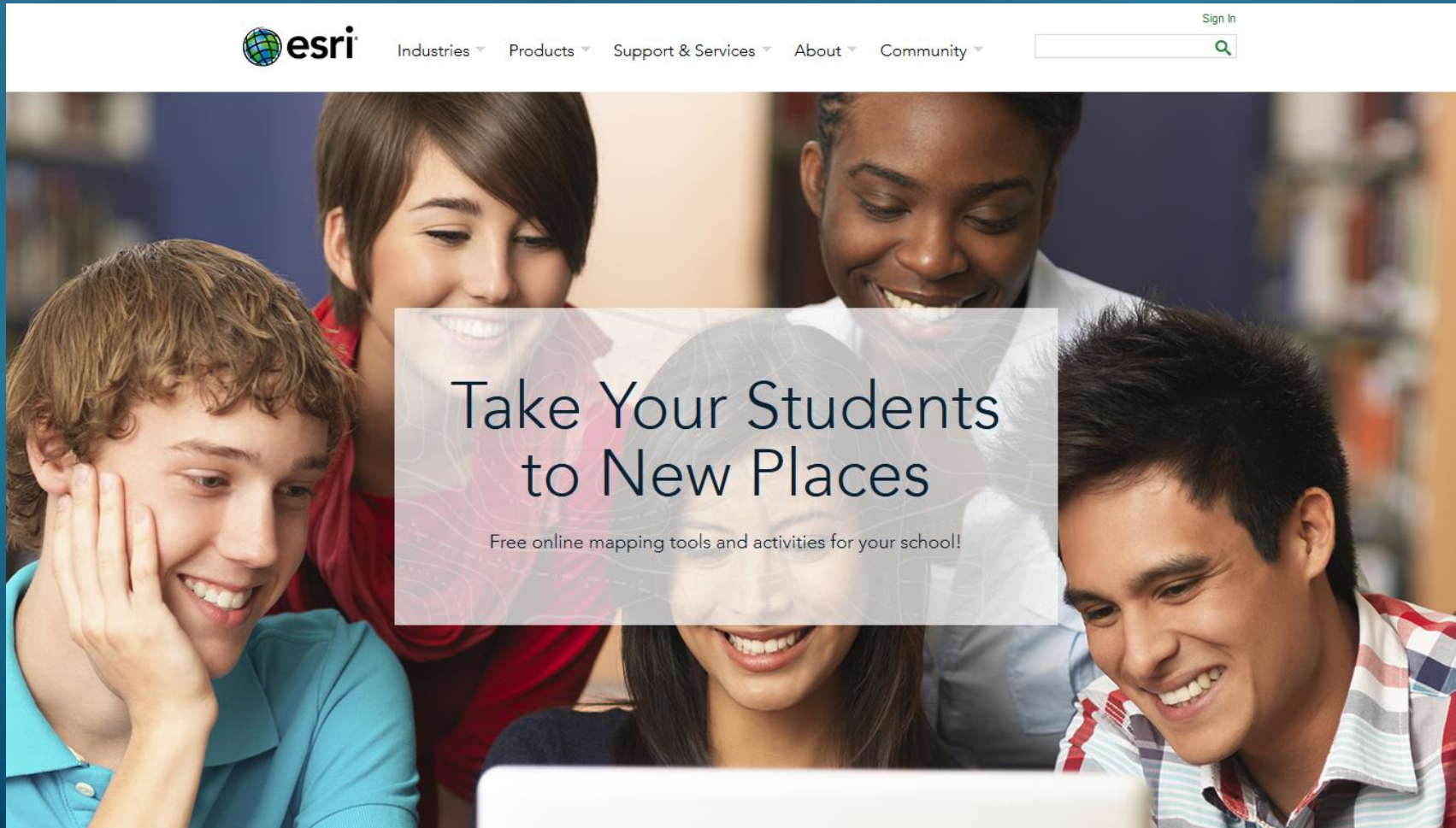
Bring GIS into your K-12 Classrooms



<http://video.esri.com/watch/4500/connected-take-your-students-to-new-places>

GIS in K-12 Schools

The Whitehouse's ConnectEd Initiative



The image shows a screenshot of the Esri website's ConnectEd Initiative banner. At the top, the Esri logo is on the left, and navigation links for Industries, Products, Support & Services, About, and Community are in the center. A search bar with a 'Sign In' link is on the right. Below the navigation bar is a large photograph of five diverse students smiling and looking at a laptop. Overlaid on the center of the photo is a semi-transparent white box containing the text 'Take Your Students to New Places' and 'Free online mapping tools and activities for your school!'.

esri Industries Products Support & Services About Community

Sign In

Take Your Students to New Places

Free online mapping tools and activities for your school!

ConnectED Initiative

**Free ArcGIS Online Accounts available for
ALL K-12 Schools in the United States!**



Request a Free US School Account X

Organization <input type="text" value="To select, begin typing."/>	Department <input type="text"/>
Street Address <input type="text"/>	City <input type="text"/>
State <input type="text" value="- Select -"/>	ZIP Code <input type="text"/>
School Website <input type="text"/>	School Phone <input type="text"/>
Contact First Name <input type="text"/>	Contact Last Name <input type="text"/>
Contact Email <input type="text"/>	<input type="checkbox"/> Agree to Terms and Conditions

Sign up online at: <http://www.esri.com/connected>
(or use the form in your binders)

ConnectED Initiative

ArcGIS Online provides **Project-based Learning**
in line with **NGSS** standards



These sites include...

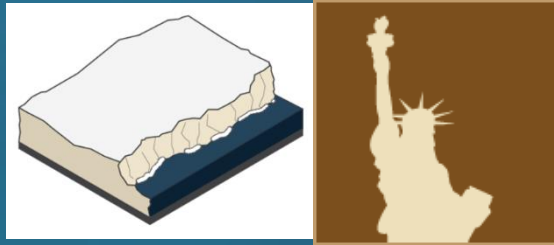
- Teacher Stories
- Student Videos
- Case Studies
- Resources
- Lessons Plans

<http://www.esri.com/connected/>

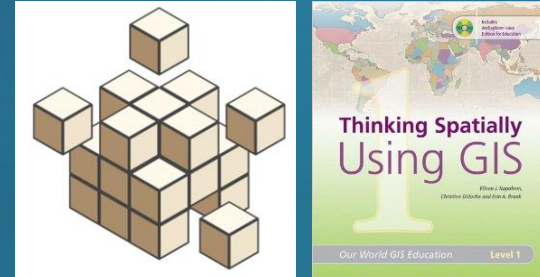
& <http://edcommunity.esri.com/>

Instructional GIS Materials for K-12

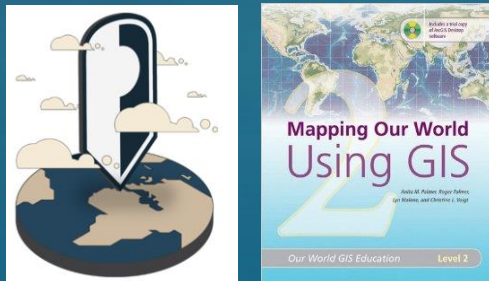
GeoInquiries



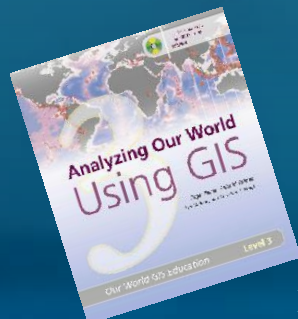
Thinking Spatially



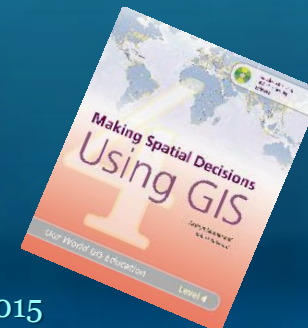
Mapping our World



Story Maps



and more!



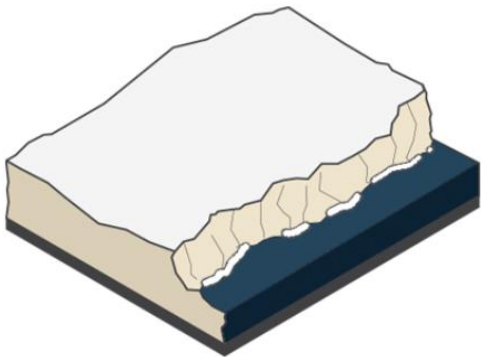
Map-based Inquiry Lessons

Earth Science GeoInquiries

Get short and easy-to-use instructional activities for the earth science classroom that apply advanced web mapping technology

Recommended grades: 6-9

Time per lesson: 15 minutes




- | | | | |
|---|----------------------------|----|-------------------------------|
| 1 | Topographic maps | 9 | Mountain building |
| 2 | Remote sensing | 10 | Fresh water |
| 3 | Minerals / Mining | 11 | Ocean features |
| 4 | Rock Types | 12 | Atmosphere and Ocean Currents |
| 5 | Landforms | 13 | Weather |
| 6 | Plate boundaries/tectonics | 14 | Storms |
| 7 | Earthquakes | 15 | Climate change |
| 8 | Volcanoes | | |

These activities do NOT require logging in
& can be done with or without an ArcGIS Online (AGOL) account

<http://edcommunity.esri.com/geoinquiries/>

Tropical Storm GeoInquiry



Tropical storms

ATMOSPHERE

Target audience – Earth Science, grades 6-9 Time required – 15 minutes

Activity Use hurricane track information to understand factors that encourage the formation of hurricanes.

Science Standards MS-ESS2-5 – Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.

Learning Outcomes

- Students will use the tracks of hurricanes in 2005 to compare wind speed to the air pressure within the hurricane and sea surface temperature.
- Students will determine the impact of air pressure and sea surface temperature on hurricane strength.

Map URL: <http://bit.ly/earthgeo inquiry14>

Engage

Where and how do tropical storms form?

- Click Modify Map, and then click the Contents button.
- Check the box next to Hurricanes Wind Strength to turn the layer on.
- Click any point on the trails of these hurricane.
- ? What information is stored for each point along the way? *[Information about air pressure, wind speed, and ocean temperature is stored.]*
- All hurricanes start as tropical depressions (TD).
- Use the Filter Tooltip instructions to filter Hurricane Wind Strength – Category – Is – TD.
- Where do most Atlantic storms reach TD status? *[Most become TD east of the Caribbean.]*

Explore

How does air pressure relate to wind speed in hurricanes?

- The 2005 Atlantic storms caused \$160 billion in damage and 3,913 deaths. Winds cause property damage by blowing off roofs or collapsing buildings, but they also push the surface of the water into a storm swell. Homes and small buildings do not stand a chance against storm-driven ocean swells. Winds are generated by greater differences in air pressure and the geographic size of the low pressure.
- Hover on the Hurricane Wind Strength layer name, click the right drop-down arrow, and then click Show Table.
- In the Hurricane Wind Strength table, click the WIND_KTS (wind speed in knots) column header.
- Click Sort Ascending to arrange the wind speed values in increasing order.
- ? As you scroll down the table, how does the pressure column change relative to wind speed? *[They are inversely proportional to each other.]*

Explain

What determines the path a storm takes?

- ? Are there areas where lower pressures do not have as strong of winds? *[Winds are generally much smaller over land.]*
- ? Why do wind speeds slow down over land? *[Rougher land surfaces provide friction, slowing winds down. Also, the heat of evaporated water condensing into clouds is cut off over land.]*
- Close the Hurricane Wind Strength table.

more ►

Elaborate

Where do tropical storms get such strength?

- Click the Hurricane Strengthening Zone bookmark.
- Turn on the Sea Temperature 05 layer.
- Click the Sea Temperature 05 title, and then click the AvSeaTemp05 subtitle to expand this layer's legend.
- ? At what temperature do storms consistently pick up energy? *(You can also click the dots to verify temperatures.) [Hurricanes may be sustained at lower temperatures, but most storms really grow above 28°C.]*

Evaluate

What other areas of the world have good conditions for tropical storms?

- Use the Filter Data toolbox instructions to identify one of the names of the storms.
- Click each dot, and on a whiteboard, create a table of wind speeds and pressure.
- Create a graph of wind speed vs. pressure. *[Wind speed should be on the x axis. The pressure should be on the y axis—the resulting graph will go down to the right.]*
- ? What type of relationship do these two variables have? *[This is an inverse relationship.]*
- Click the Home button to zoom out to the entire world.
- ? List two other areas in the world that would be possible targets for tropical storms. *[China, Philippines, Indonesia, and Australia are all possible targets.]*

FILTER DATA

- Hover on the layer name, click the drop-down arrow, and choose Filter.
- Build the expression Name - Is - Unique.
- Scroll down to choose a unique hurricane name.
- Click Apply Filter, and then click Zoom To.

BOOKMARK

- At the top of the map, click the Bookmarks button.
- Choose your bookmark; the map will take you there.

Next Steps

DID YOU KNOW? ArcGIS Online is a mapping platform freely available to U.S. public, private, and home schools as a part of the White House CONNECTED Initiative. A school subscription provides additional security, privacy, and content features. Learn more about ArcGIS Online and how to get a school subscription at <http://connected.esri.com>.

THEN TRY THIS...

- Add a U.S. states layer, perform analysis, and aggregate hurricane wind strength by states.
- Color the new layer based on how many hurricanes have crossed the state borders.

TEXT REFERENCES

This GIS map has been cross-referenced to material in the weather sections of chapters from middle-school texts.

- Earth Science by Glencoe McGraw Hill – Chapter 16
- Earth Science by Holt – Chapter 16
- Earth Science by McDougal Littell – Chapter 3D
- Earth Science by Prentice Hall – Chapter 17

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Tropical Storm GeoInquiry



Tropical storms

Target audience – Earth Science, grades 6-9

Time required – 15 minutes

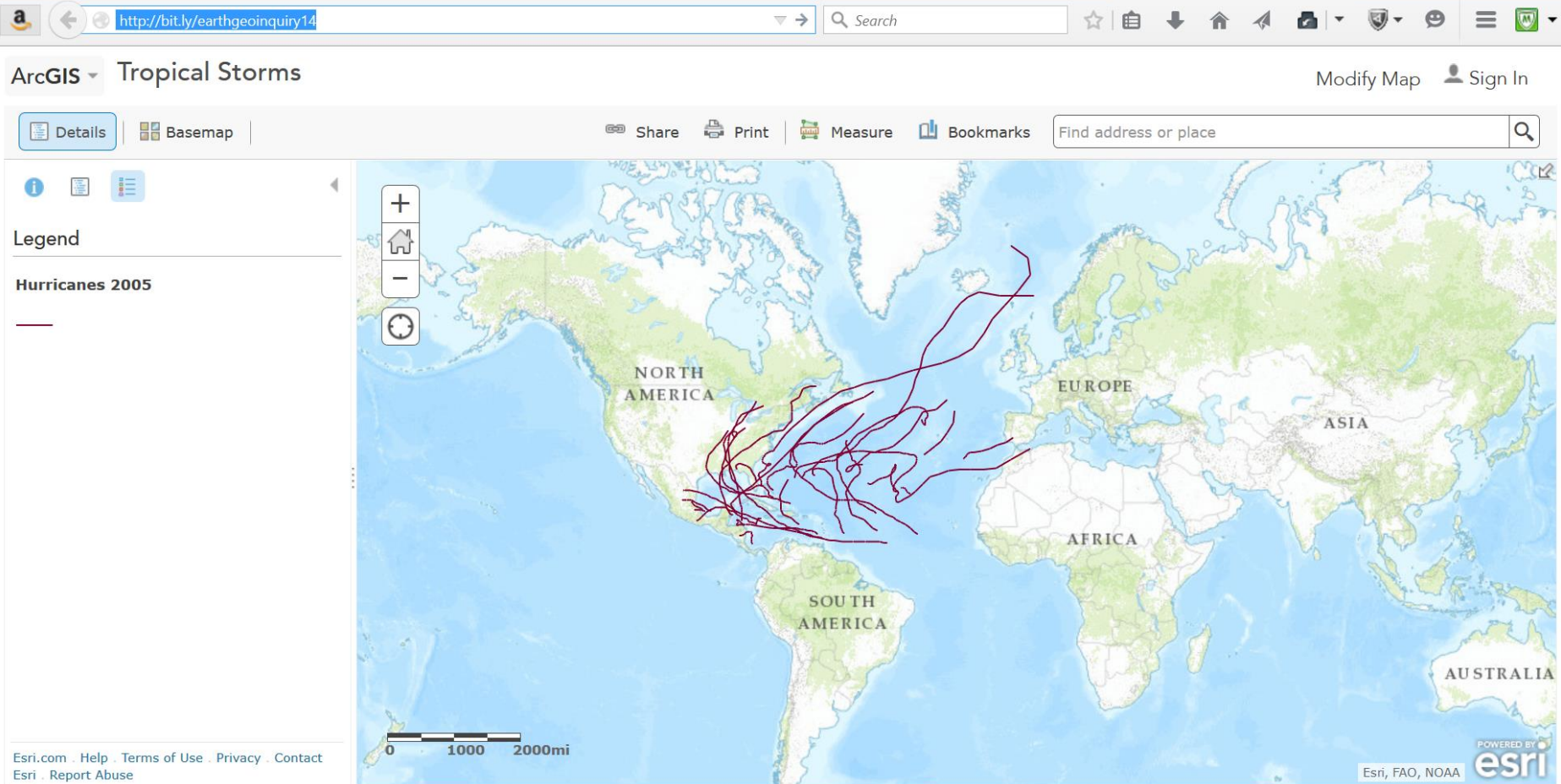
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Use hurricane track information to understand factors that encourage the formation of hurricanes.

Elaborate

Where do tropical storms get such strength?

- Click the Hurricane Strengthening Zone bookmark.
- Turn on the Sea Temperature 05 layer.
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- ? At what temperature do storms consistently pick up energy? (You can also click the dots to verify temperatures.) *Hurricanes may be weakened at lower temperatures, but most storms reach the warm ocean 28°C/1*



Tropical Storm GeoInquiry



Tropical storms

Target audience – Earth Science, grades 6-9

Time required – 15 minutes

Activity	Use hurricane track information to understand factors that encourage the formation of hurricanes.
Science Standards	MS-ESS2-5 – Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
Learning Outcomes	<ul style="list-style-type: none"> Students will use the tracks of hurricanes in 2005 to compare wind speed to the air pressure within the hurricane and sea surface temperature. Students will determine the impact of air pressure and sea surface temperature on hurricane strength.

Map URL: <http://bit.ly/earthgeoenquiry14>

Engage

Where and how do tropical storms form?

- Click Modify Map, and then click the Contents button.
- Check the box next to Hurricanes Wind Strength to turn the layer on.
- Click any point on the trails of these hurricane.
- What information is stored for each point along the way? *[Information about air pressure, wind speed, and ocean temperature is stored.]*
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- Where do most Atlantic storms reach TD status? *[Most become TD east of the Caribbean.]*

Explore

How does air pressure relate to wind speed in hurricanes?

- The 2005 Atlantic storms caused \$160 billion in damage and 3,913 deaths. Winds cause property damage by blowing off roofs or collapsing buildings, but they also push the surface of the water into a storm swell. Homes and small buildings do not stand a chance against storm-driven ocean swells. Winds are generated by greater differences in air pressure and the geographic size of the low pressure.
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ArcGIS Tropical Storms

1

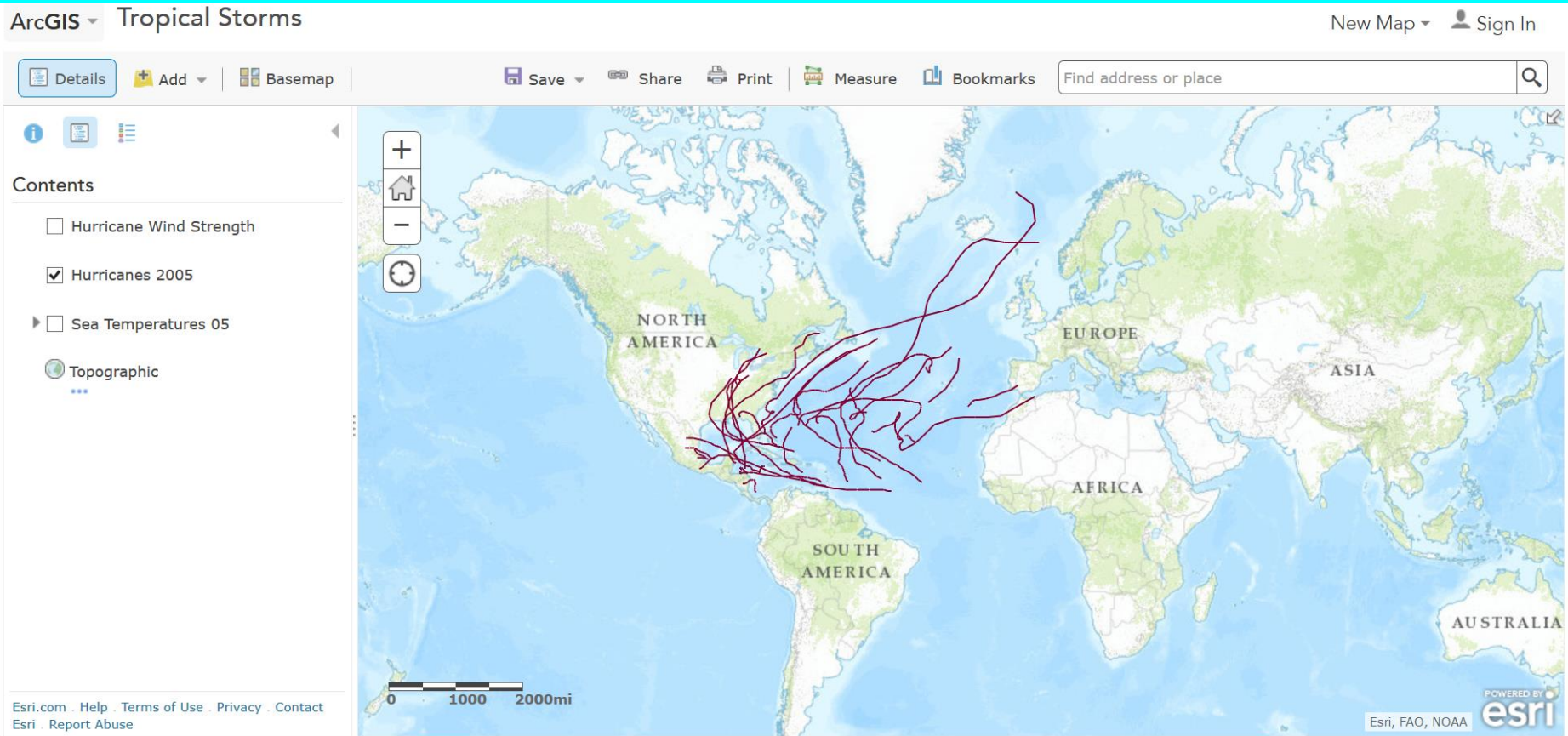
Modify Map

Sign In



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Where and how do tropical storms form?


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- Where do most Atlantic storms reach TD status? *[Most become TD east of the Caribbean.]*

ArcGIS Tropical Storms New Map ▾ Sign In

Details Add ▾ Basemap Save ▾ Share Print Measure Bookmarks Find address or place 🔍

Contents

- 3** ☐ Hurricane Wind Strength
- ☒ Hurricanes 2005
- ☐ Sea Temperatures 05
- ☒ Topographic

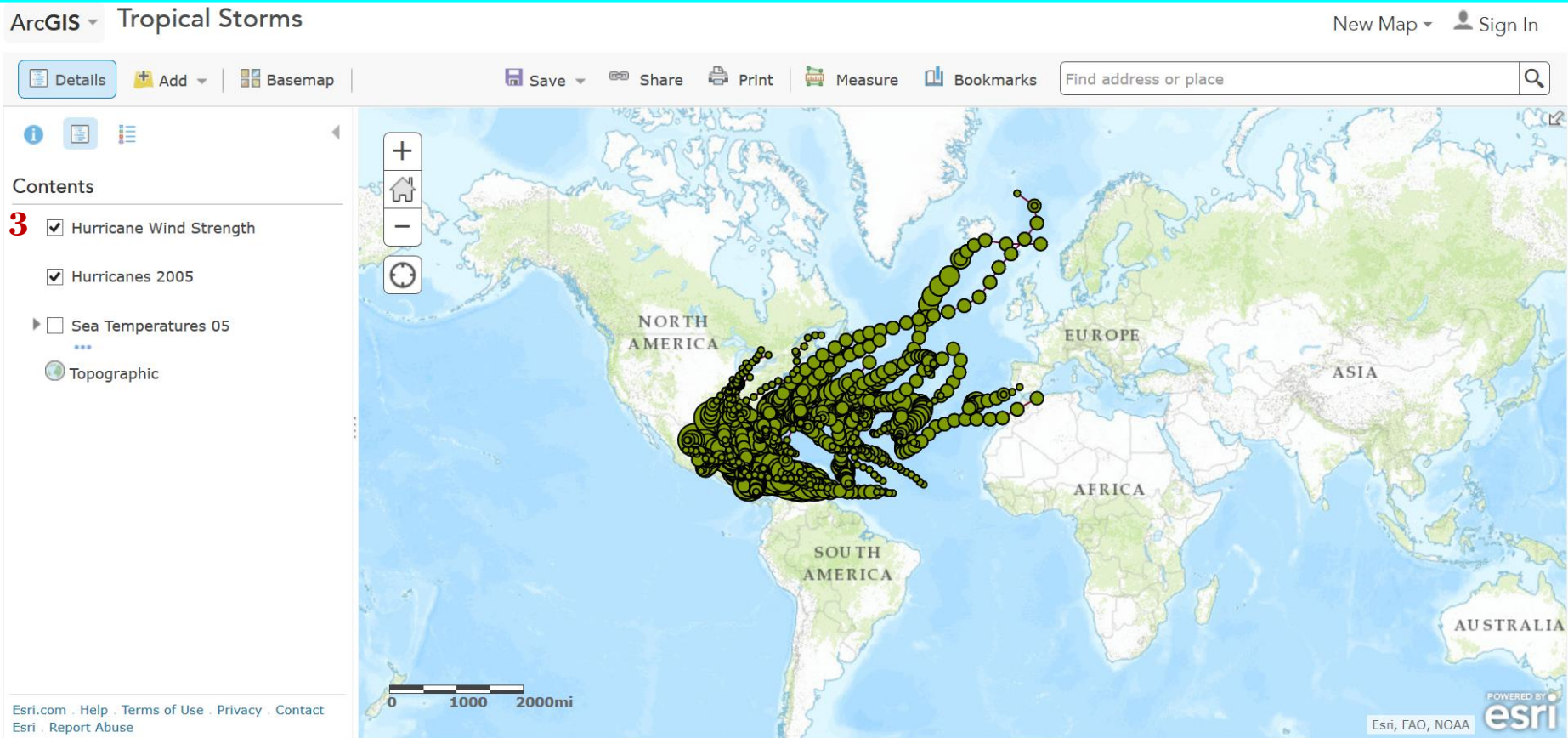


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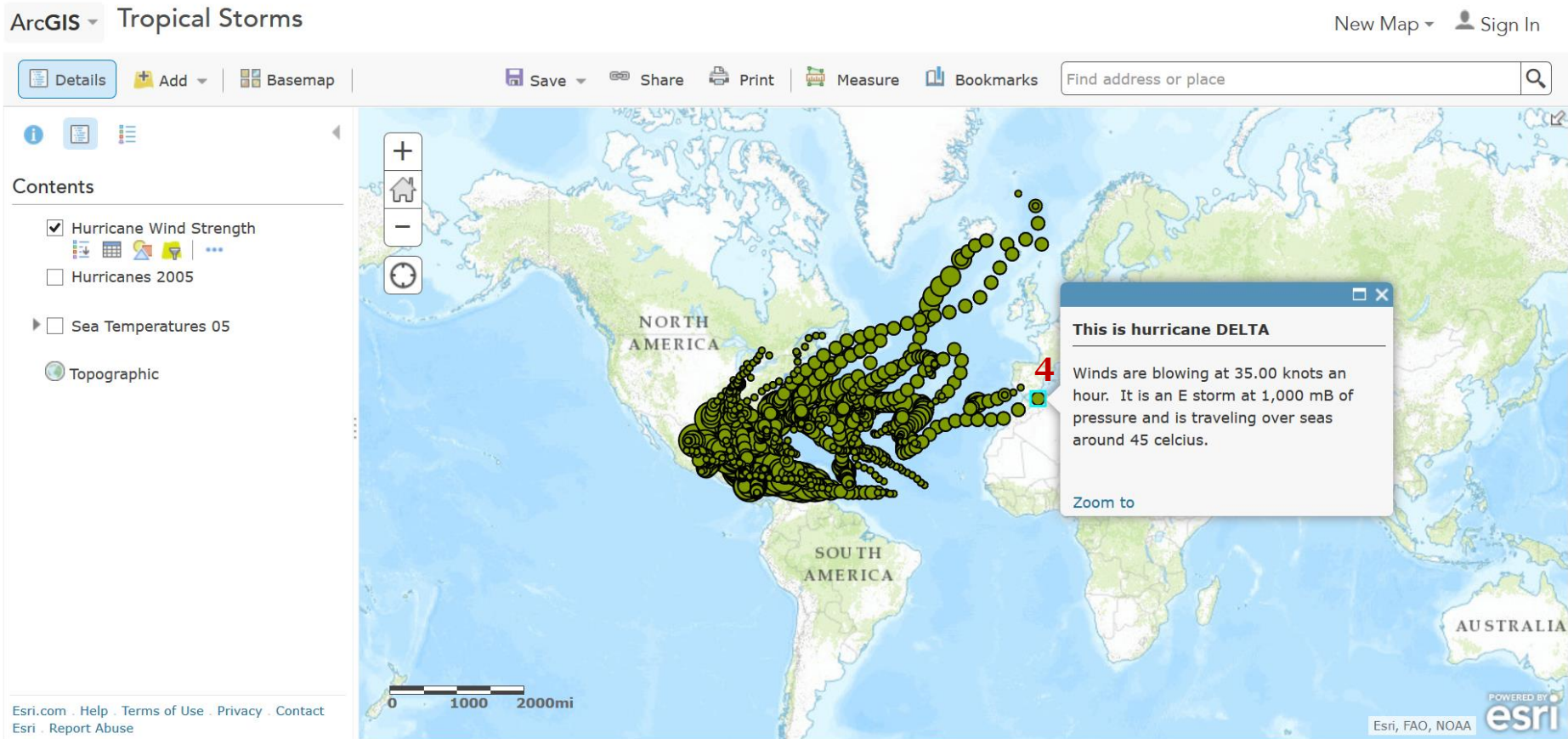
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ArcGIS Tropical Storms

New Map ▾ Sign In

Details Add ▾ Basemap Save ▾ Share Print Measure Bookmarks Find address or place 🔍

Contents

- ☒ Hurricane Wind Strength **5**
- ☐ Hurricanes 2005
- ☐ Sea Temperatures 05
- ☐ Topographic

Map showing the Atlantic Ocean with hurricane tracks (green dots) and a tooltip for Hurricane Delta.

This is hurricane DELTA

Winds are blowing at 35.00 knots an hour. It is an E storm at 1,000 mB of pressure and is traveling over seas around 45 celcius.

Zoom to

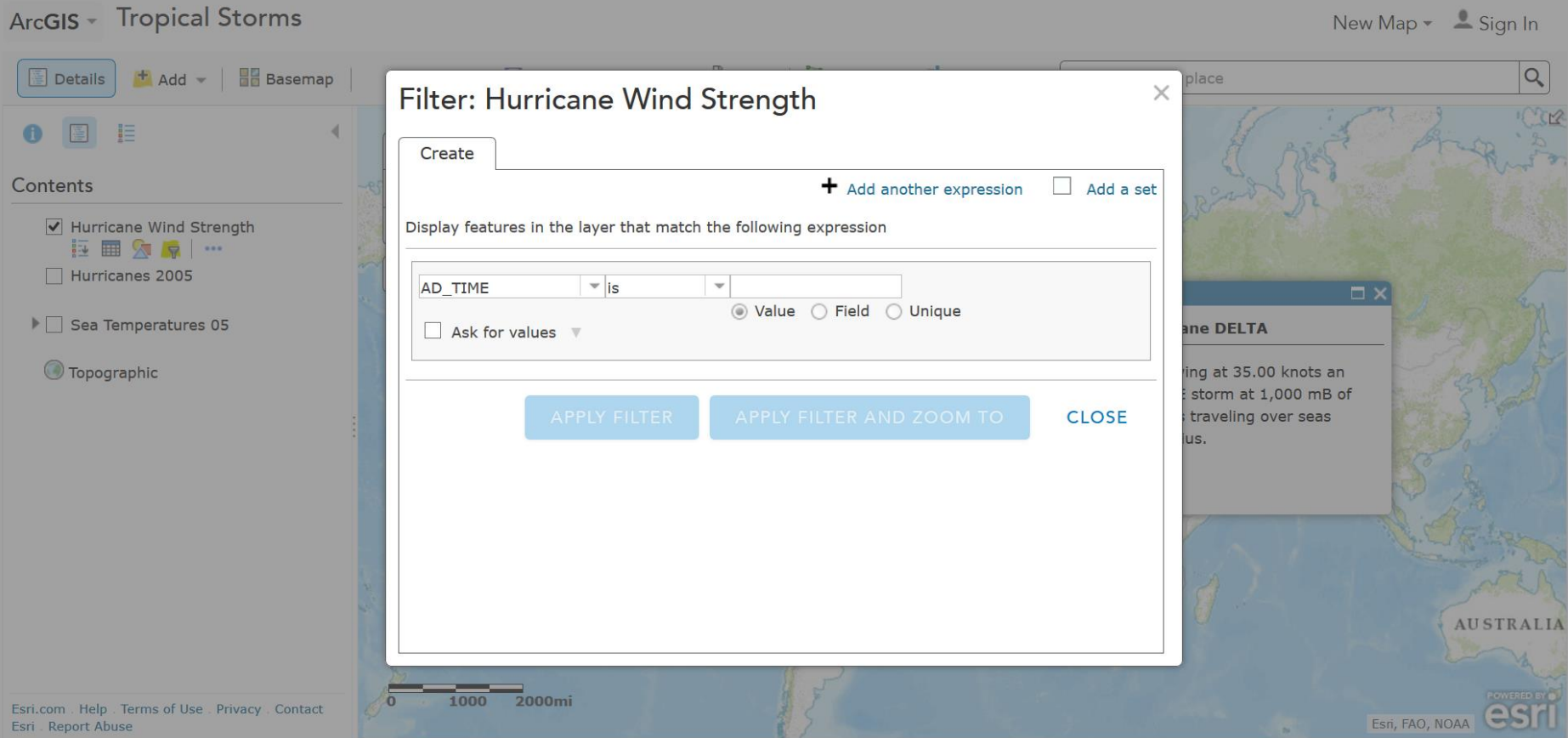
0 1000 2000mi

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The screenshot shows the ArcGIS web interface for 'Tropical Storms'. The 'Contents' panel on the left lists several layers: 'Hurricane Wind Strength' (checked), 'Hurricanes 2005', 'Sea Temperatures 05', and 'Topographic'. A 'Filter: Hurricane Wind Strength' dialog box is open in the center, showing the 'Create' tab. The dialog prompts the user to 'Display features in the layer that match the following expression'. The expression field contains 'AD_TIME is', with radio buttons for 'Value' (selected), 'Field', and 'Unique'. There are also buttons for 'APPLY FILTER', 'APPLY FILTER AND ZOOM TO', and 'CLOSE'. In the background, a map of the Pacific Ocean is visible, showing hurricane tracks. A tooltip for 'Hurricane DELTA' is also present, showing details about its path and speed.

ArcGIS Tropical Storms

New Map Sign In

Details Add Basemap

Contents

- ☒ Hurricane Wind Strength
- ☐ Hurricanes 2005
- ☐ Sea Temperatures 05
- ☐ Topographic

Filter: Hurricane Wind Strength

Create

+ Add another expression ☐ Add a set

Display features in the layer that match the following expression

AD_TIME is

☒ Value ☐ Field ☐ Unique

☐ Ask for values

APPLY FILTER APPLY FILTER AND ZOOM TO CLOSE

Hurricane DELTA

ing at 35.00 knots an
storm at 1,000 mB of
traveling over seas
us.

0 1000 2000mi

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esri

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ArcGIS Tropical Storms

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ArcGIS **Tropical Storms** New Map Sign In

Details Add Basemap Save Share Print Measure Bookmarks Find address or place

Contents

- ☒ Hurricane Wind Strength
- ☐ Hurricanes 2005
- ☐ Sea Temperatures 05
- ☐ Topographic



0 1000 2000mi

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Esri, FAO, NOAA

Tropical Storm GeoInquiry



Tropical storms

Target audience – Earth Science, grades 6-9

Time required – 15 minutes

Activity

Use hurricane track information to understand factors that encourage the formation of hurricanes.

Science Standards

MS-ESS2-5 – Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.

Elaborate

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Evaluate

ArcGIS Tropical Storms

New Map ▾ Sign In

Details

Add ▾

Basemap

Save ▾

Share

Print

Measure

Bookmarks

Find address or place



Contents

☒ Hurricane Wind Strength

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Elaborate

Where do tropical storms get such strength?

- 6 → Click the Hurricane Strengthening Zone bookmark.
→ Turn on the Sea Temperature 05 layer.
→ Click the Sea Temperature 05 title, and then click the AvSeaTemp05 subtitle to expand this layer's legend.
? At what temperature do storms consistently pick up energy? (You can also click the dots to verify temperatures.) *[Hurricanes may be sustained at lower temperatures, but most storms really grow above 28°C.]*





Elaborate

Where do tropical storms get such strength?

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ArcGIS **Tropical Storms** New Map ▾ Sign In

Details Add ▾ Basemap Save ▾ Share Print Measure Bookmarks Find address or place 🔍

Contents

- ☒ Hurricane Wind Strength
- ☐ Hurricanes 2005
- ☐ Sea Temperatures 05
- ☐ Topographic

Map showing the Atlantic Ocean and surrounding continents (North America, South America, Africa, Asia, Australia). A red box highlights the "Strengthening zone" bookmark. A scale bar indicates 0, 1000, and 2000 miles. The map is powered by Esri, FAO, and NOAA.

6

Bookmarked places

- Strengthening zone

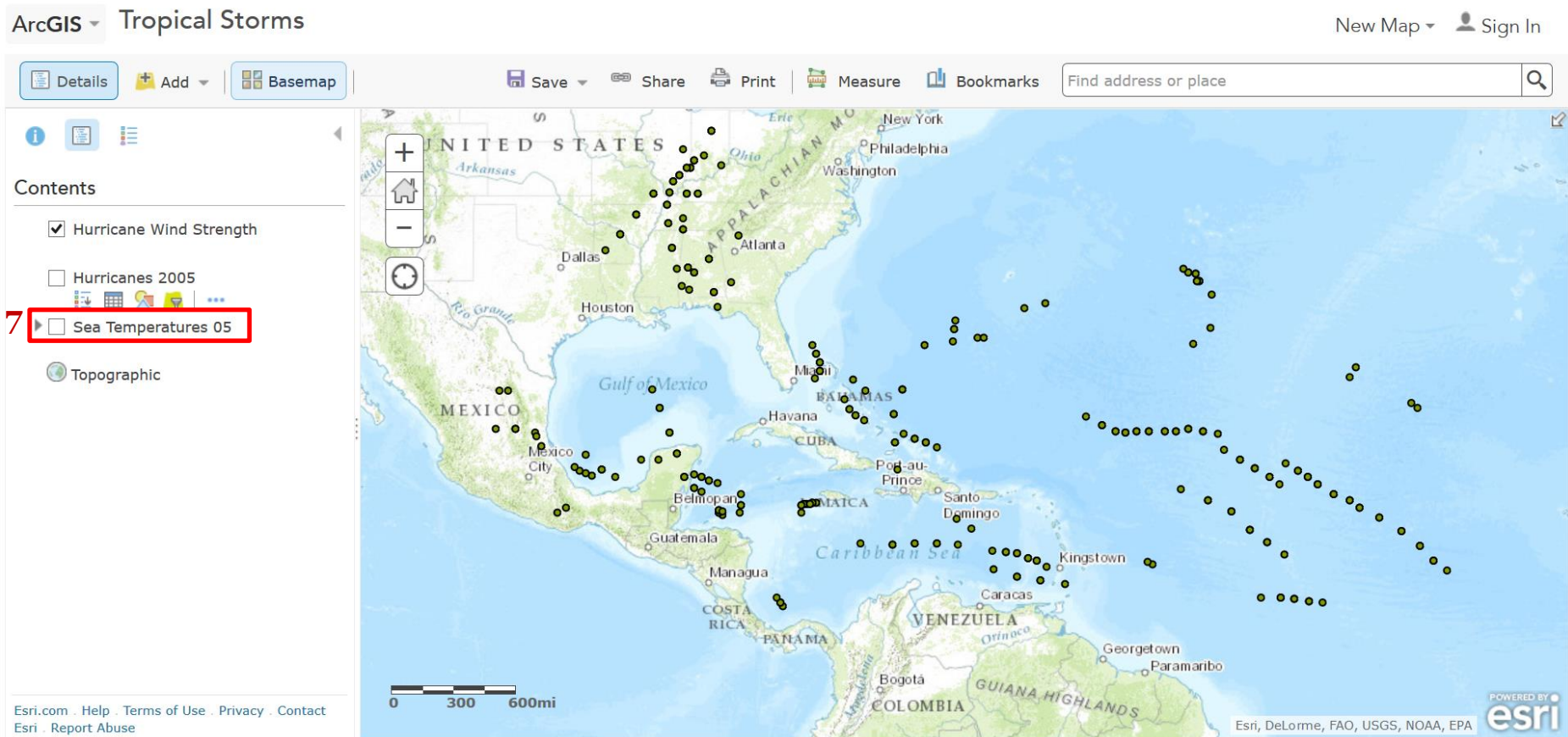
Add Bookmark



Elaborate

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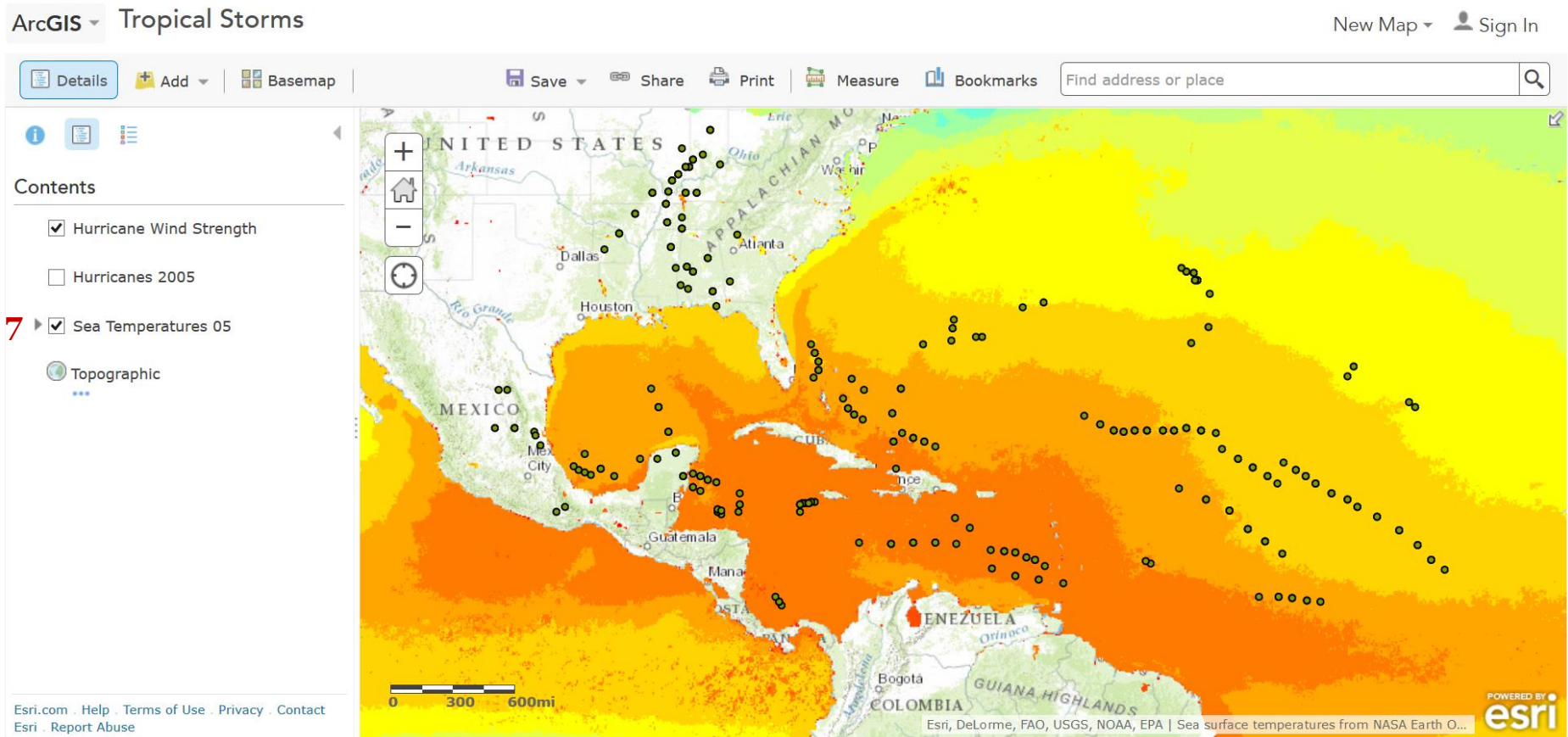




Elaborate

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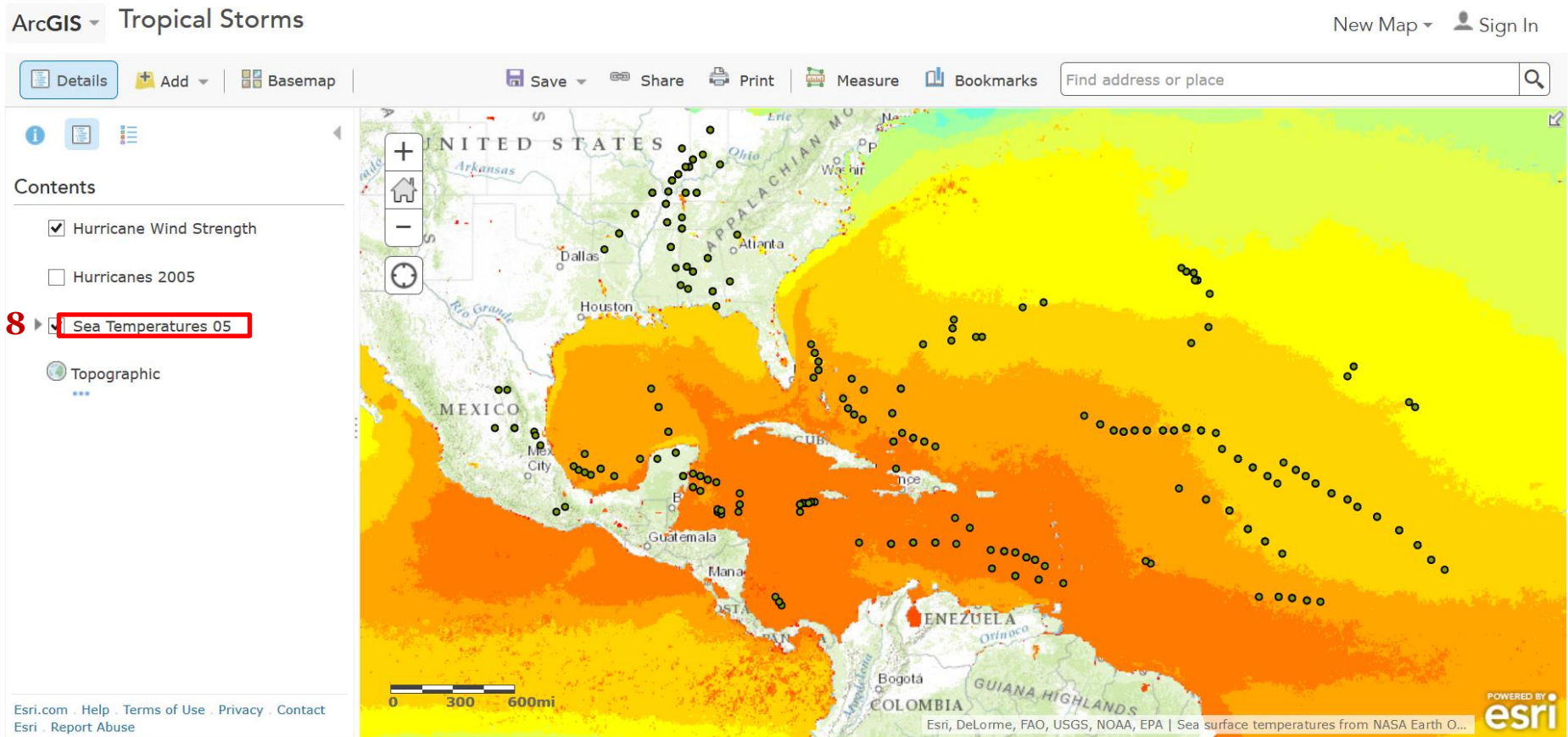




Elaborate

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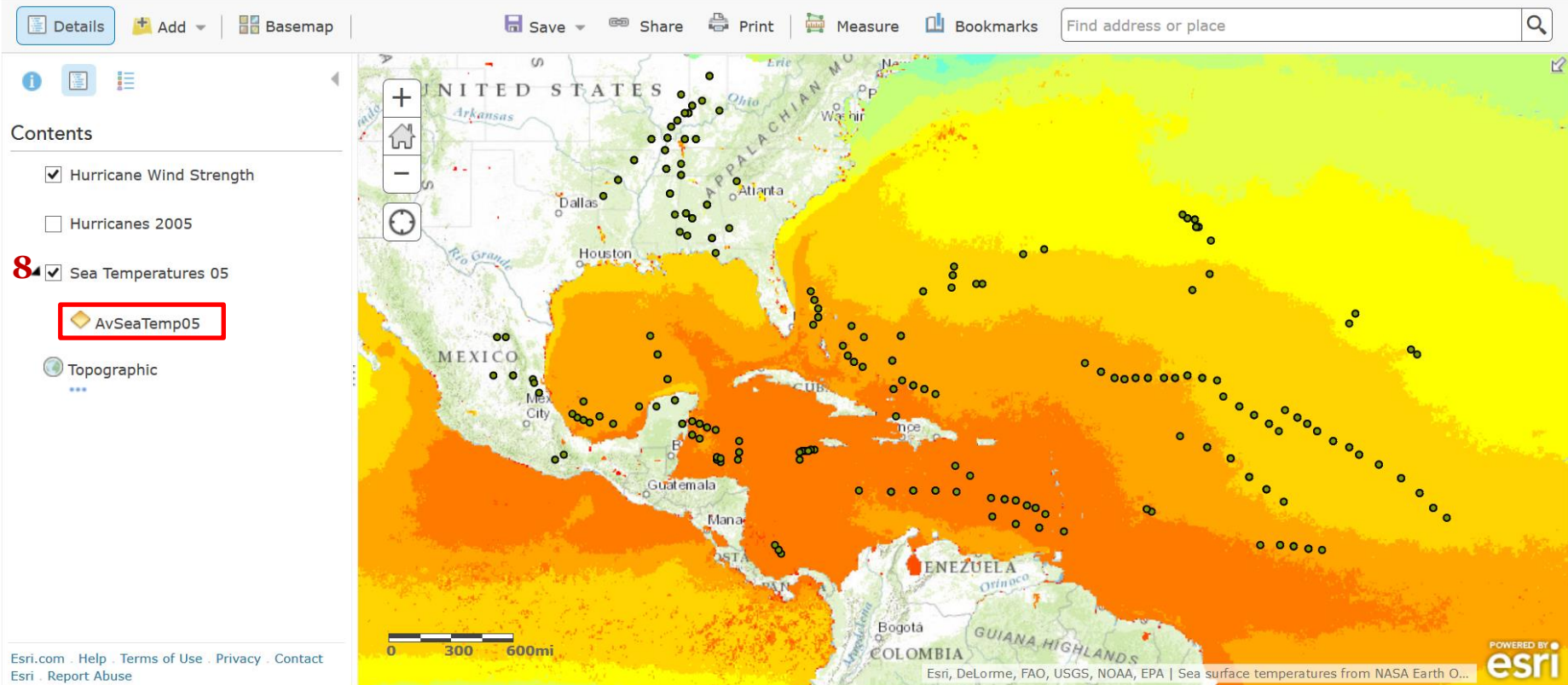
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ArcGIS Tropical Storms

New Map ▾ Sign In





Elaborate

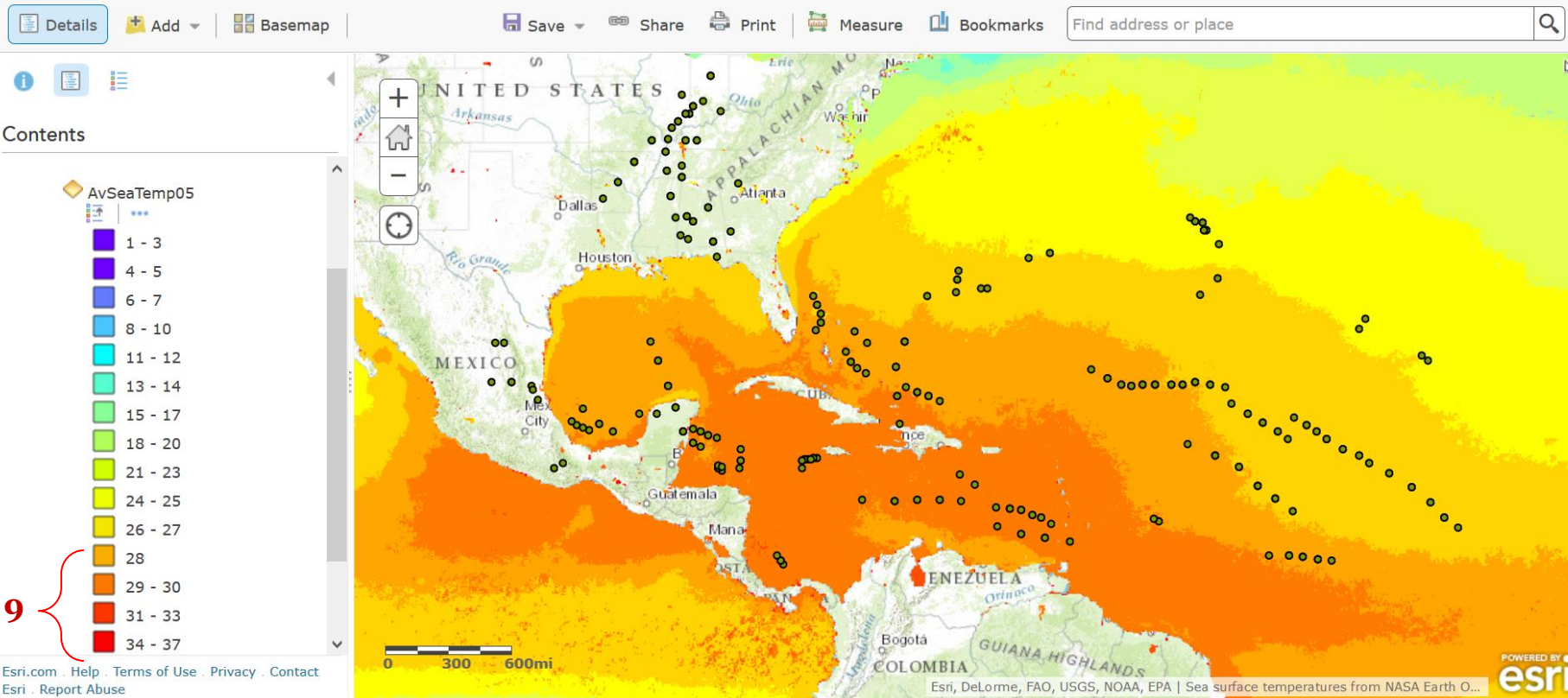
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ArcGIS Tropical Storms

New Map ▾ Sign In



**More
GeoInquiries**
(coming soon)

US History

- 1 The Thirteen Colonies to the 1700's
- 2 Revolutionary War (undetermined)
- 3 The War of 1812
- 4 American Trails West, 1860
- 5 The Underground Railroad, 1850-1860
- 6 Civil War, 1861-1865
- 7 Native American Lands and Battle sites
- 8 American natural resources/ Industrialization**
- 9 Allied Victories, 1917-1918 (boundary changes)
- 10 The Dust Bowl, 1933-1936**
- 11 Pre-Civil War: Compromise, shifting lands, slavery growth
- 12 World War II: Pearl Harbor
- 12 War World II: D-Day
- 14 Cold War: Alliances, Warsaw, NATO, hot spots
- 15 The Great (Columbian) Exchange**

**Currently Available*

**More
GeoInquiries**
(coming soon)

AP Human Geography

- 1 The Thirteen Colonies to the 1700's
- 2 Revolutionary War (undetermined)
- 3 The War of 1812
- 4 American Trails West, 1860
- 5 The Underground Railroad, 1850-1860
- 6 Civil War, 1861-1865
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Map-based Inquiry Lessons

Thinking Spatially Using GIS

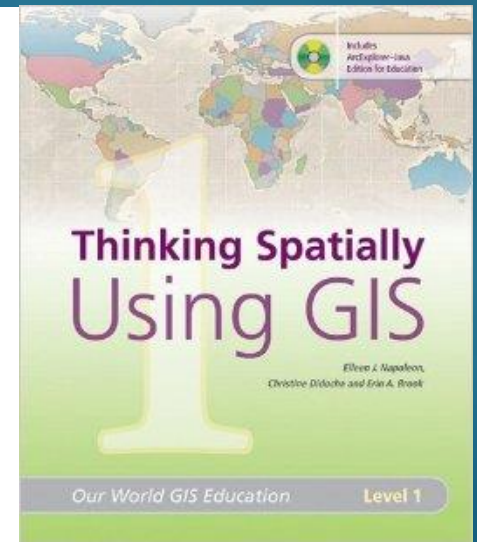
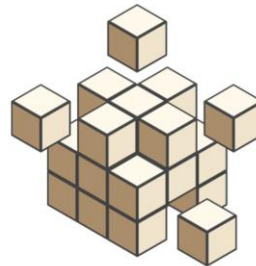
Provide structured lessons in elementary geography using ArcGIS Online software

Recommended grades: 4-6

Time per lesson: 30-60 minutes

Lessons available at edcommunity.esri.com/TSG include the following:

- World Exploration
- The Animal Kingdom
- People and Patterns
- US Tornadoes



These activities do NOT require logging in
& can be done with or without an ArcGIS Online (AGOL) account

<http://edcommunity.esri.com/TSG/>

Map-based Inquiry Lessons

Mapping Our World

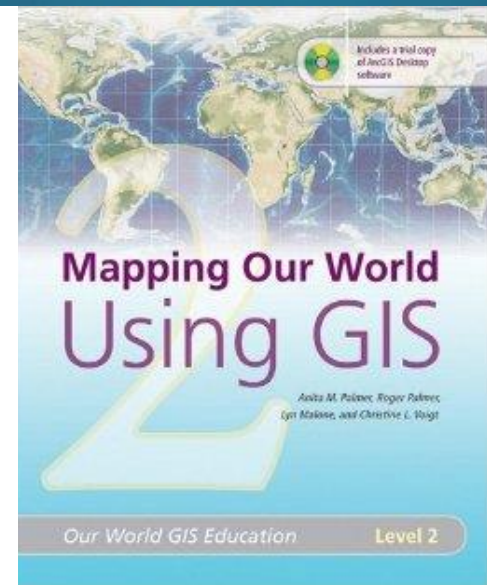
Provide structured lessons in geography, social studies, and environmental science using ArcGIS Online software

Recommended grades: 6-12

Time per lesson: 45-90 minutes

Lessons available at edcommunity.esri.com/MOW include the following:

- Geographic Inquiry
- Geology
- Climate
- Population
- Boundaries
- Forces of Nature



These activities do NOT require logging in
& can be done with or without an ArcGIS Online (AGOL) account

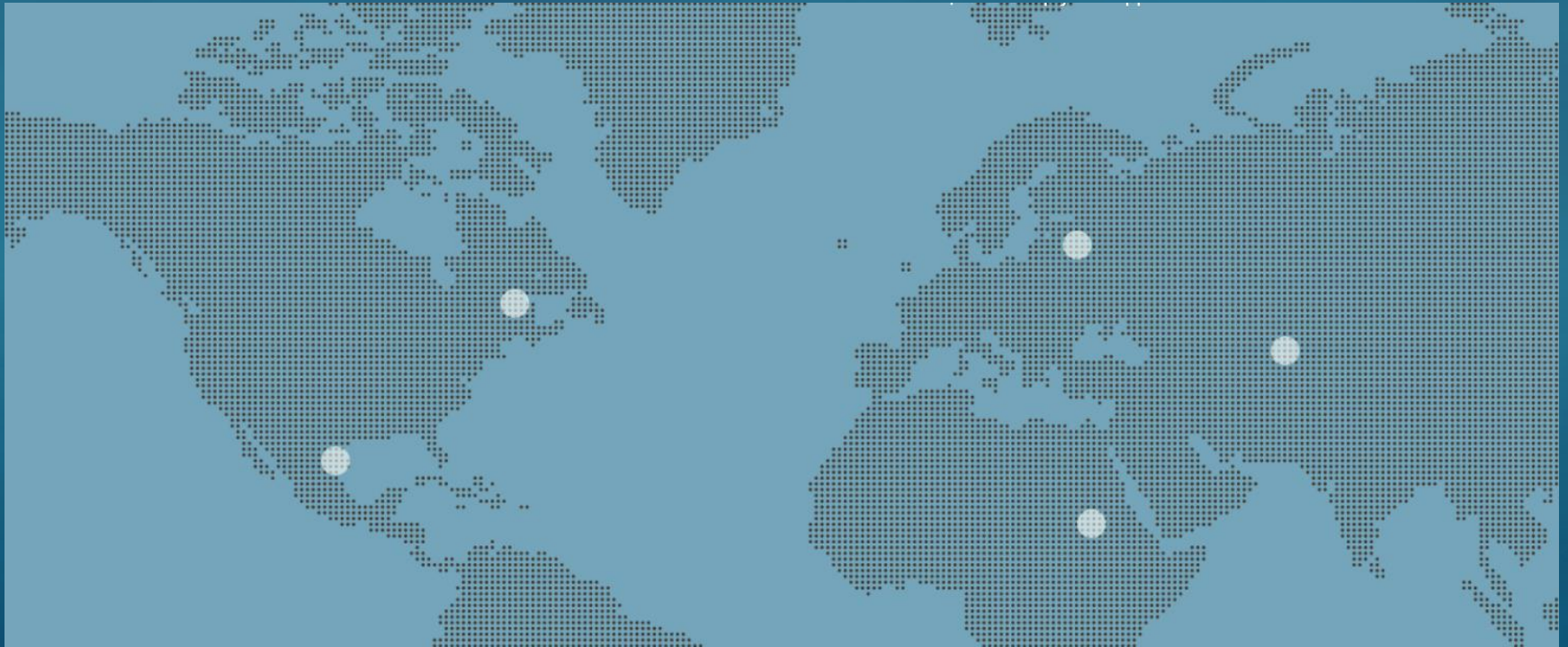
<http://edcommunity.esri.com/MOV/>

Map-based Inquiry Lessons

Story Maps

story map it (verb):

“to actively engage your audience with your data, analysis, and projects”



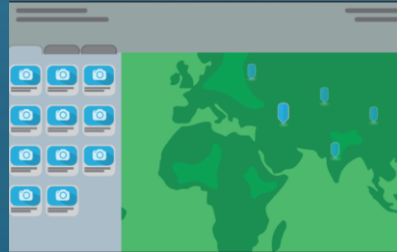
<http://storymaps.arcgis.com/>

Story Map Templates

Basic



Shortlist

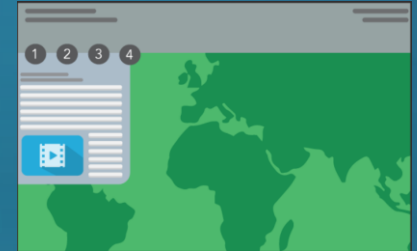


Swipe

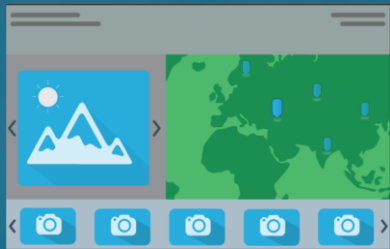


Map Series

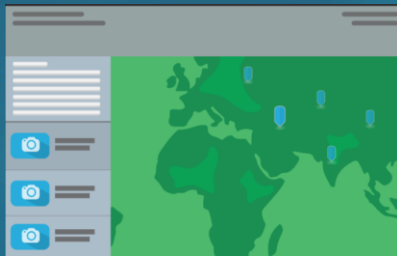
Bulleted layout



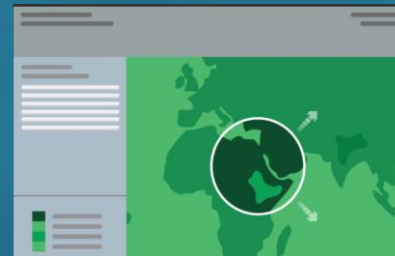
Map Tour



Playlist



Spy Glass



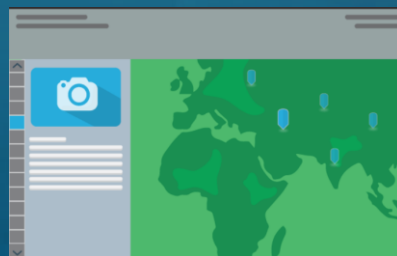
Tabbed layout



Map Journal



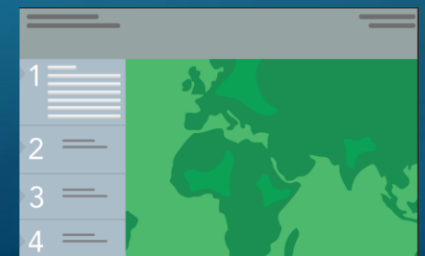
Countdown



Custom Designs



Side Accordion layout



<http://storymaps.arcgis.com/en/app-list/>

Story Maps cover Core Content



A story map    

We are Living in
The Age of Humans

Innovation in U.S. Cities

Cities across the country are seeking creative ways to adapt to climate change and to reduce the negative effects of urban life on natural systems. Explore the following maps for a small sampling of advances in sustainability.



<http://arcg.is/1uGgg6X>

Story Maps cover Core Content

Living on the Edge: The Extremes of Human Inhabitation

brought to you by a planet mapper [f](#) [t](#) [e](#)

Living on the Edge

The Hottest

The Coldest

The Rainiest

The Driest

The Highest

The Lowest

The Most Remote



photo credit

Oymyakon, Russia

Mean annual temperature: 4.2°F

(-15.4°C)

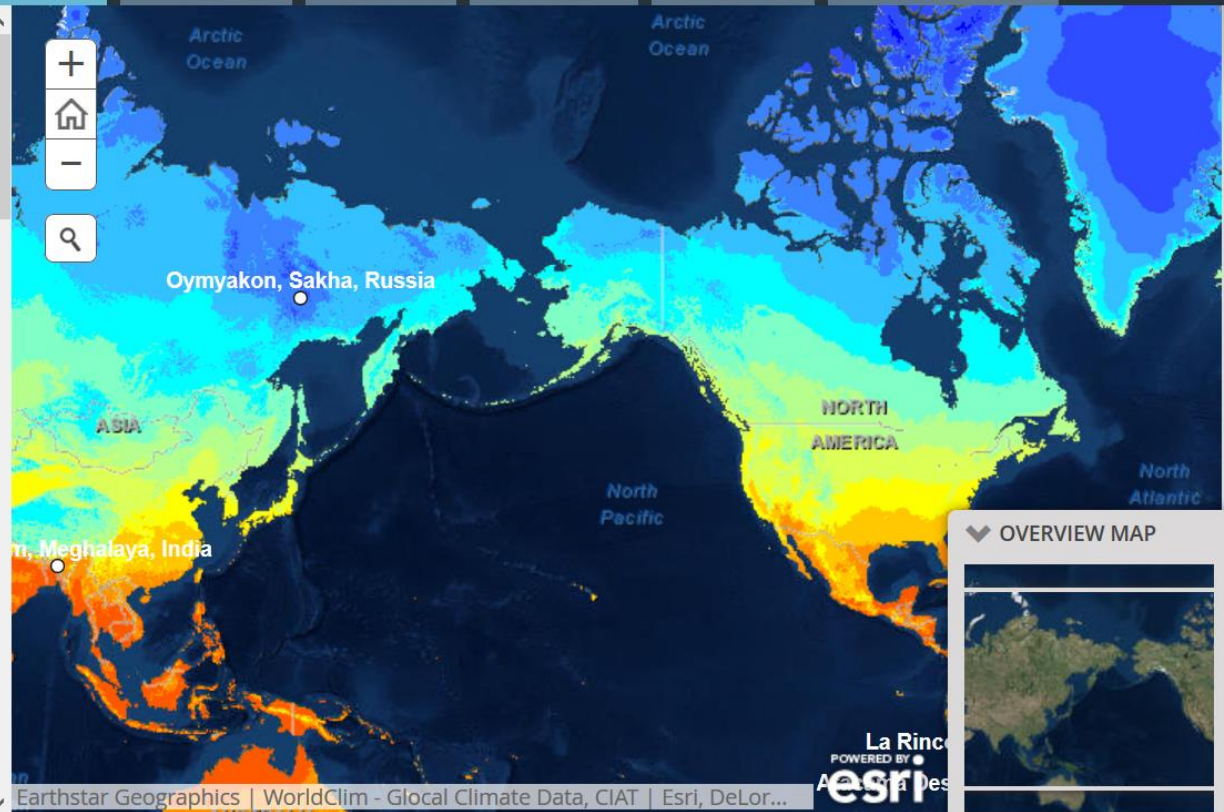
Lowest recorded temperature: -90°F

(-67.8°C)

Population: 547

There's chilly, there's cold, and then there's Oymyakon. Several hundred miles from the Arctic Circle, this village in Siberia is nicknamed the "**Pole of Cold.**"

The valley it's nestled in, far from the temperature-moderating effects of a sea, looks cold. Arctic winds gust Oymyakon...



<http://arcg.is/1eQCUYp>

Story Maps cover Core Content

The Assassination of Abraham Lincoln

April 14 marks the 150th anniversary of the assassination of Abraham Lincoln. This map tour recounts the bizarre saga of John Wilkes Booth and his co-conspirators.

A story map



1865: Booth in Washington

1865: Booth in Washington

Booth boarded in the National Hotel at the corner of 6th Street and Pennsylvania Avenue NW. The site is now occupied by the Newseum. Booth, a prominent actor, was admired by Lincoln. Library of Congress

- 1865: Booth in Washington
- March 4, 1865: Lincoln's second inaugural
- March 17: Kidnapping plan foiled
- April 14, morning: The Kirkwood House
- April 14, morning: Ford's Theatre
- April 14, late afternoon: Stalking Ulysses S. Grant
- April 14, evening: Booth waits for Lincoln
- April 14, 10:13 p.m.: The president is shot
- April 14, 10:15 p.m.: Seward attacked and wounded
- April 14, 10:15 p.m.: Seward attacked and wounded

<http://arcg.is/1NTUPL3>

Story Maps cover Core Content

A Story Map by JMT    Prologue 

Mapping Segregation in Washington DC Legal Challenges to Racially Restrictive Covenants



The rise of segregation in DC during the first half of the 20th century coincided with a period of rapid population growth. The exodus of African Americans from the South accelerated as Jim Crow took hold during the 1890s, and DC offered unique educational and employment opportunities.

However, restrictive deed covenants confined much of DC's rapidly expanding black population to substandard, overcrowded



<http://arcg.is/1dLq259>

Story Maps cover Core Content






plate tectonics

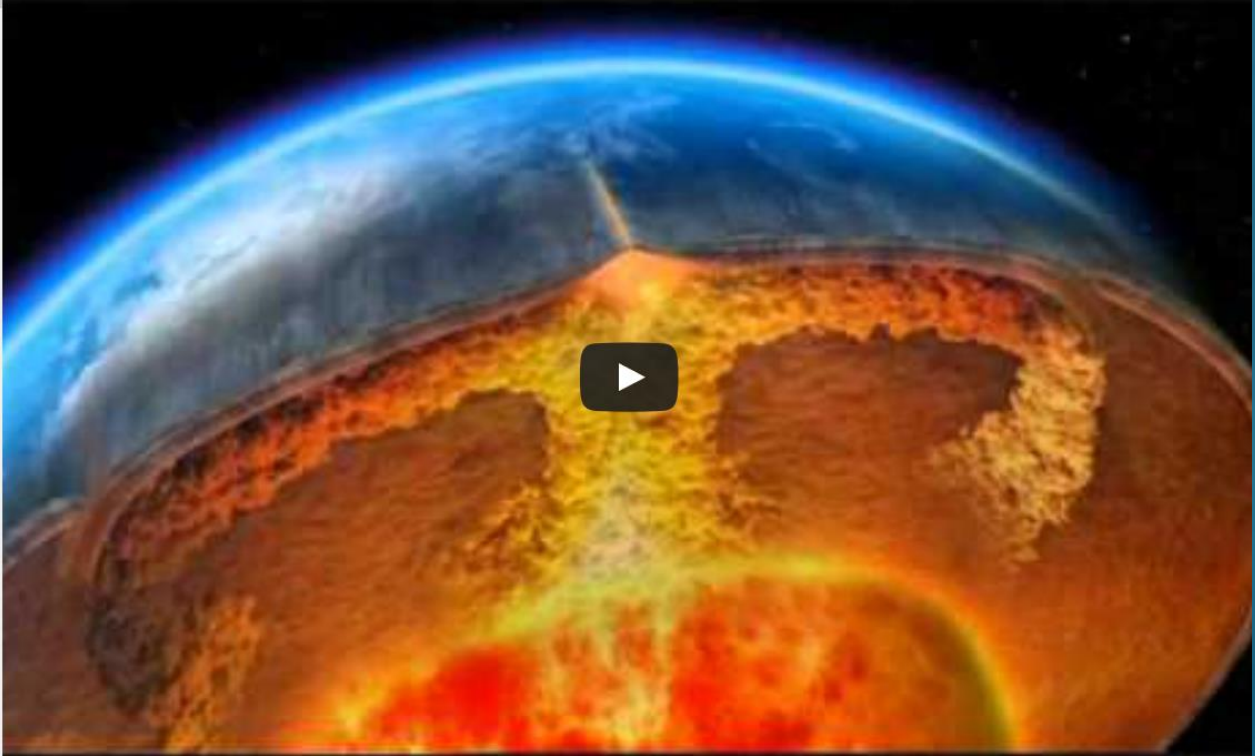
Motion of Tectonic Plates

This story map tells the tale of Earth's tectonic plates, their secret conspiracies, awe-inspiring exhibitions and subtle impacts on the maps and geospatial information we so often take for granted as unambiguous. But is it? You will find yourself hovering over the Mid-Atlantic Ridge, or swimming in magma deep within the Earth's core. Have fun and we hope your voyage is fruitful!

The opening video to the right was published by altervision and comes from BBC film "Earth, The Power of the Planet".

Plate Tectonics

From center to surface, the Earth consists of three main layers: a dense, solid core, a viscous mantle, and a thin, solid crust or lithosphere. The crust is the outermost layer of the Earth. Continental crust is variable in



<http://apl.maps.arcgis.com/apps/MapJournal/?appid=df5f94c0050b4075adfbba54fb13eae6>

Story Maps work on Multiple Platforms








Story Maps work on Multiple Platforms




The Aquarium's Story Maps website

[Home](#) [Gallery](#) [Map](#) [Scene](#) [Groups](#) [Sign In](#)




Story Maps Website

Story Maps and other GIS-related projects




Penguins
Story Map

AOP's Magellanic Penguins Story Map




Steelhead
Story Map

AOP's Southern California Steelhead Story Map



The GREEN Aquarium
Story Map (working draft)

AOP, The GREEN Aquarium (working draft)



BTI 2014 Workshop
Story Map (working draft)

BTI 2014 Workshop (working draft)

The Aquarium of the Pacific's mission is to instill a sense of wonder, respect, and stewardship for the Pacific Ocean, its inhabitants, and ecosystems. Our vision is to create an aquarium dedicated to conserving and building Natural Capital (Nature and Nature's services) by building Social Capital (the interactions between and among peoples).

The Aquarium of the Pacific (AOP) is the fourth most-attended aquarium in the nation. It displays over 12,000 animals in more than 50 exhibits that represent the diversity of the Pacific Ocean. Each year more than 1.5 million people visit the Aquarium. Beyond its world-class animal exhibits, the Aquarium offers educational programs for people of all ages from hands-on activities to lectures by leading scientists. Through these programs and a variety of multimedia experiences, the Aquarium provides opportunities to delve deeper into ocean science and learn more about our planet. The Aquarium of the Pacific has redefined the modern aquarium. It is a community gathering place where diverse cultures and the arts are celebrated and a place where important topics facing our planet and our ocean are explored by scientists, policy-makers and stakeholders in the search for sustainable solutions.

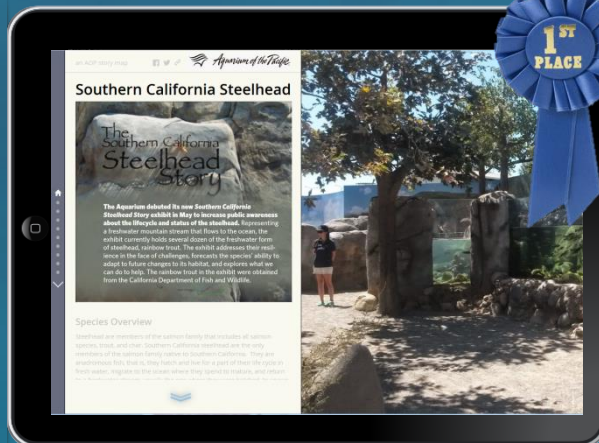
<http://aop.maps.arcgis.com>

Using Story Maps to help guests learn more about our...

Animals



Exhibits



Experiences



Locations



Issues



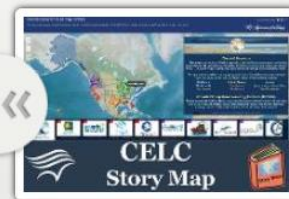
Example of a Story Map about our Animals

[HOME](#) [GALLERY](#) [MAP](#) [SCENE](#) [GROUPS](#)

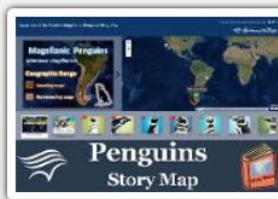
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Story Maps and other GIS-related projects



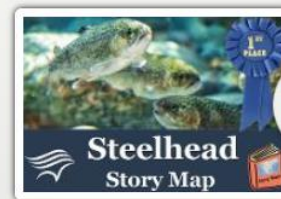
AOP's CELC Story Map



AOP's Magellanic Penguins Story Map



AOP's Seafood Story Map



AOP's Southern California Steelhead Story Map

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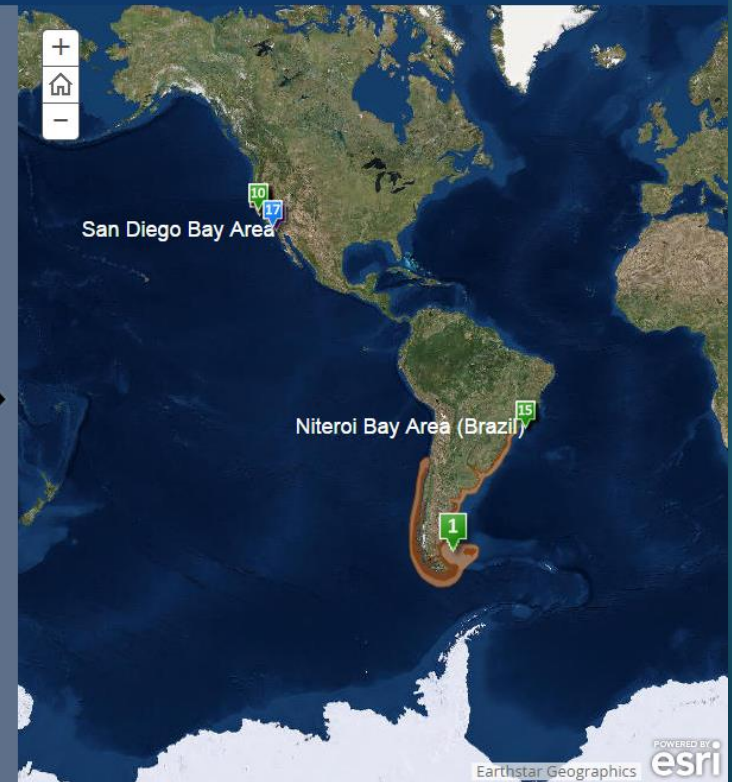
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Example of a Story Map about our Animals

Aquarium of the Pacific's Magellanic Penguins Story Map

An Aquarium of the Pacific (AOP) story map [f](#) [t](#) [e](#)

Aquarium of the Pacific



Example of a Story Map about our Animals

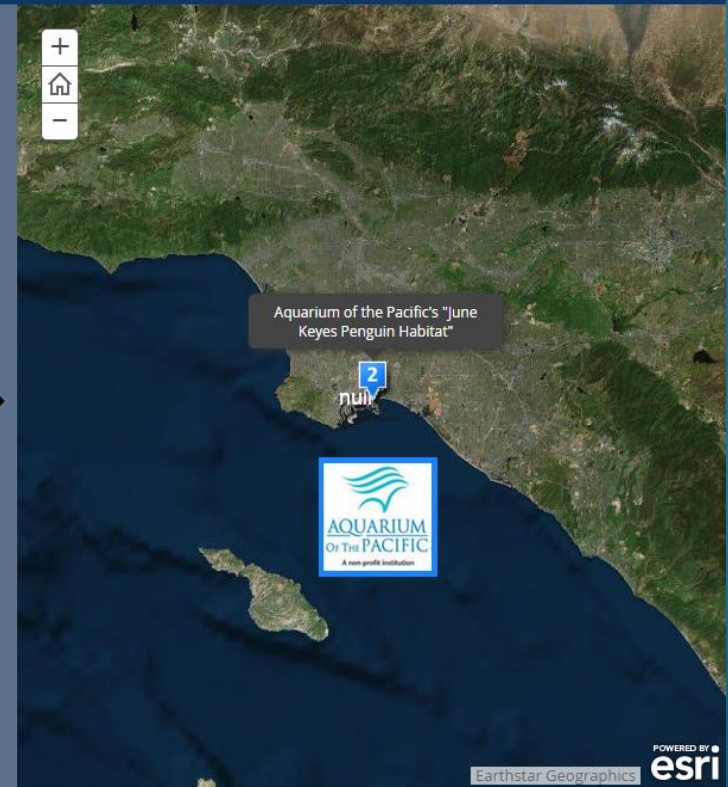
Aquarium of the Pacific's Magellanic Penguins Story Map

An Aquarium of the Pacific (AOP) story map [f](#) [t](#) [e](#)



Aquarium of the Pacific's "June Keyes Penguin Habitat"

Get up-close with more than a dozen Magellanic Penguins both above and below the water in the new June Keyes Penguin Habitat. Some of our penguins were born in facilities that are part of the Association of Zoos and Aquariums (AZA) "Species Survival Program." Others were rescued from the coast of Brazil. They were classified as "non-releasable," meaning their chances of surviving in the wild are very small. Our breeding colony will help the Species Survival Program maximize genetic diversity among captive penguins. Increasing the supply of captive bred penguins and passing knowledge along to our guests will help protect wild penguins.



Geographic Range



Aquarium of the Pacific's "June Keyes Penguin Habitat"



Shim ("The Big One")



Noodles ("The Bruiser")



Patsy ("The Shy One")



Whatever ("The Bold One")



Floyd ("The Curious One")



Ludwig ("The Rowdy One")

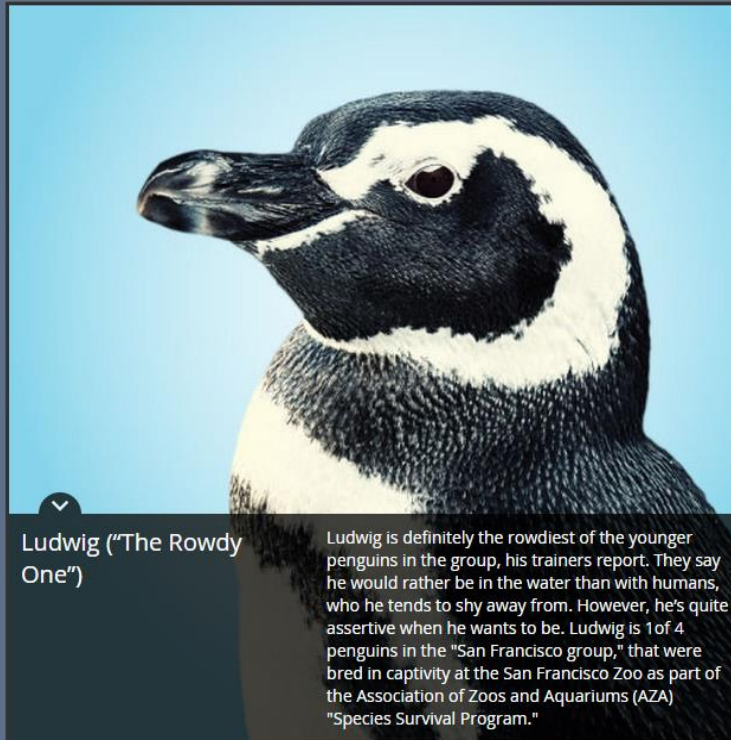


Newsom ("The Baby")

Example of a Story Map about our Animals

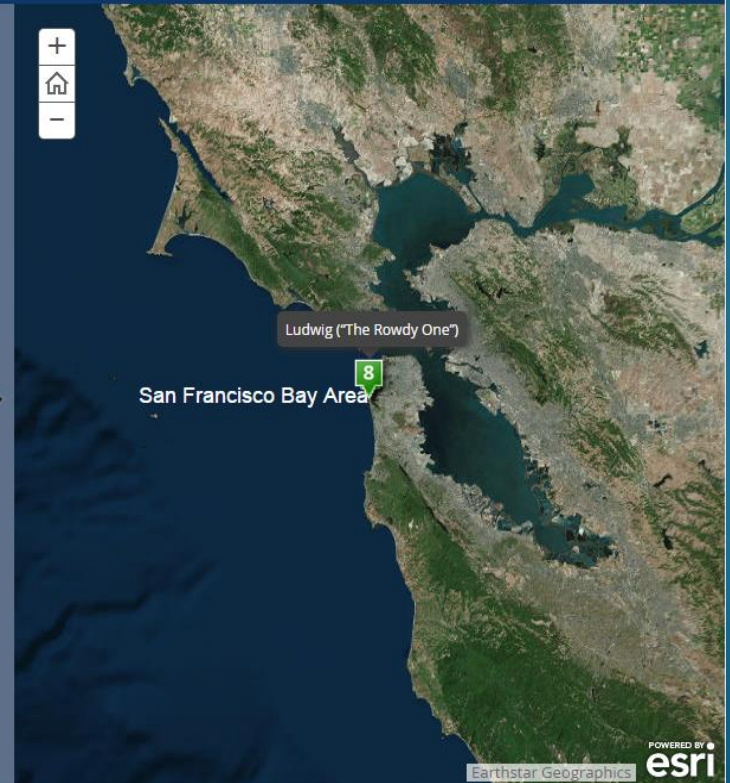
Aquarium of the Pacific's Magellanic Penguins Story Map

An Aquarium of the Pacific (AOP) story map



Ludwig ("The Rowdy One")

Ludwig is definitely the rowdiest of the younger penguins in the group, his trainers report. They say he would rather be in the water than with humans, who he tends to shy away from. However, he's quite assertive when he wants to be. Ludwig is 1 of 4 penguins in the "San Francisco group," that were bred in captivity at the San Francisco Zoo as part of the Association of Zoos and Aquariums (AZA) "Species Survival Program."



Geographic Range



Penguin Habitat
Aquarium of the Pacific's
"June Keyes Penguin"



Shim ("The Big One")



Noodles ("The Bruiser")



Patsy ("The Shy One")



Whatever ("The Bold One")



Floyd ("The Curious One")



Ludwig ("The Rowdy One")



Newsom ("The Baby")

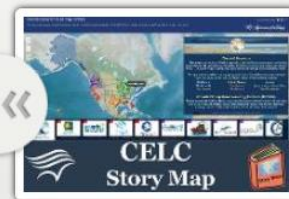
Example of a Story Map about our Exhibits

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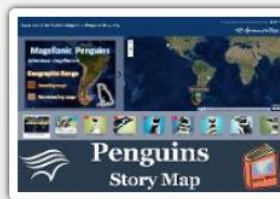
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Story Maps and other GIS-related projects



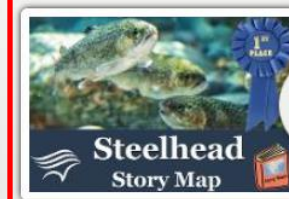
AOP's CELC Story Map



AOP's Magellanic Penguins Story Map



AOP's Seafood Story Map



AOP's Southern California Steelhead Story Map

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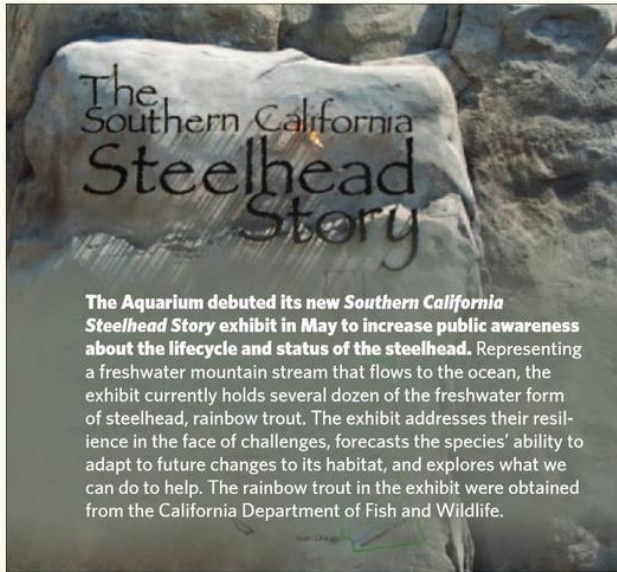
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Example of a Story Map about our Exhibits

an AOP story map

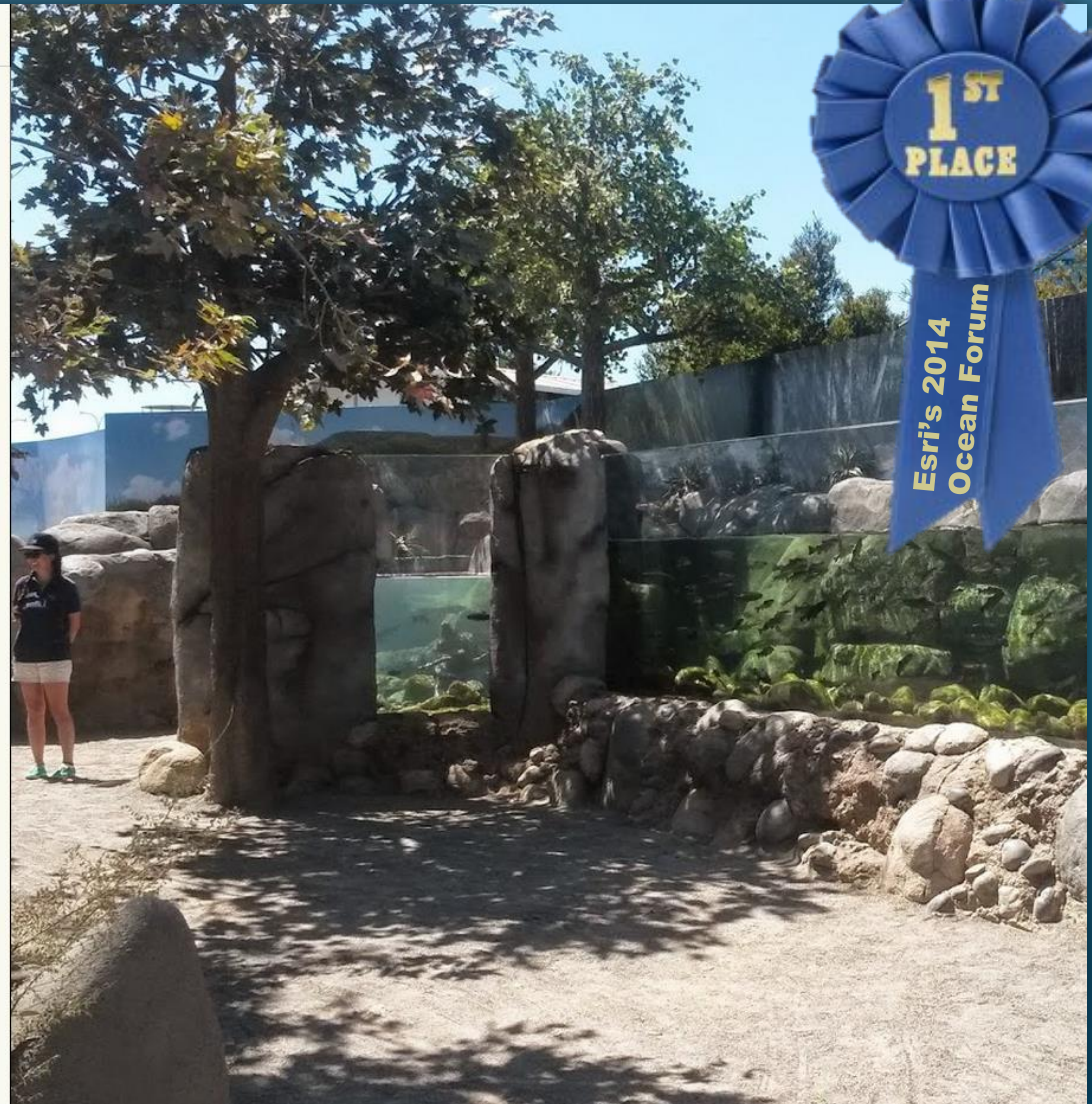


Southern California Steelhead



Species Overview

Steelhead are members of the salmon family that includes all salmon species, trout, and char. Southern California steelhead are the only members of the salmon family native to Southern California. They are anadromous fish, that is, they hatch and live for a part of their life cycle in fresh water, migrate to the ocean where they spend to mature, and return to a freshwater stream, usually the one where they were hatched, to spawn. Unlike their salmon relatives, they usually do not die after spawning.



Example of a Story Map about our Exhibits

an AOP story map

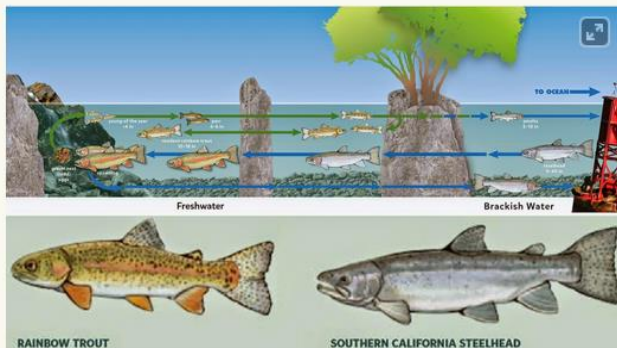


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Steelhead is the name given to ocean-going rainbow trout. Steelhead are born and remain in freshwater for 1-3 years as juveniles, then migrate to the ocean and stay for 1-4 years while growing into adults. When rivers are typically swollen in winter, adults migrate to freshwater to spawn, usually in the stream where they were born. Steelhead belong to a family that includes all salmon, trout, and char. Unlike salmon, which spawn only once, adult Steelhead often return to the ocean after spawning and repeat the spawning migration the next year.



The image on the right is a painting by Ben Lovejoy titled "A Steelhead's Journey" (<http://www.steelheadrecovery.org/images/lovejoy-painting-large.jpg>)



Example of a Story Map about our Exhibits

an AOP story map



Southern California Steelhead

Historical Southern California Steelhead Populations

At one time steelhead spawned in the majority, if not all, of California's coastal rivers.



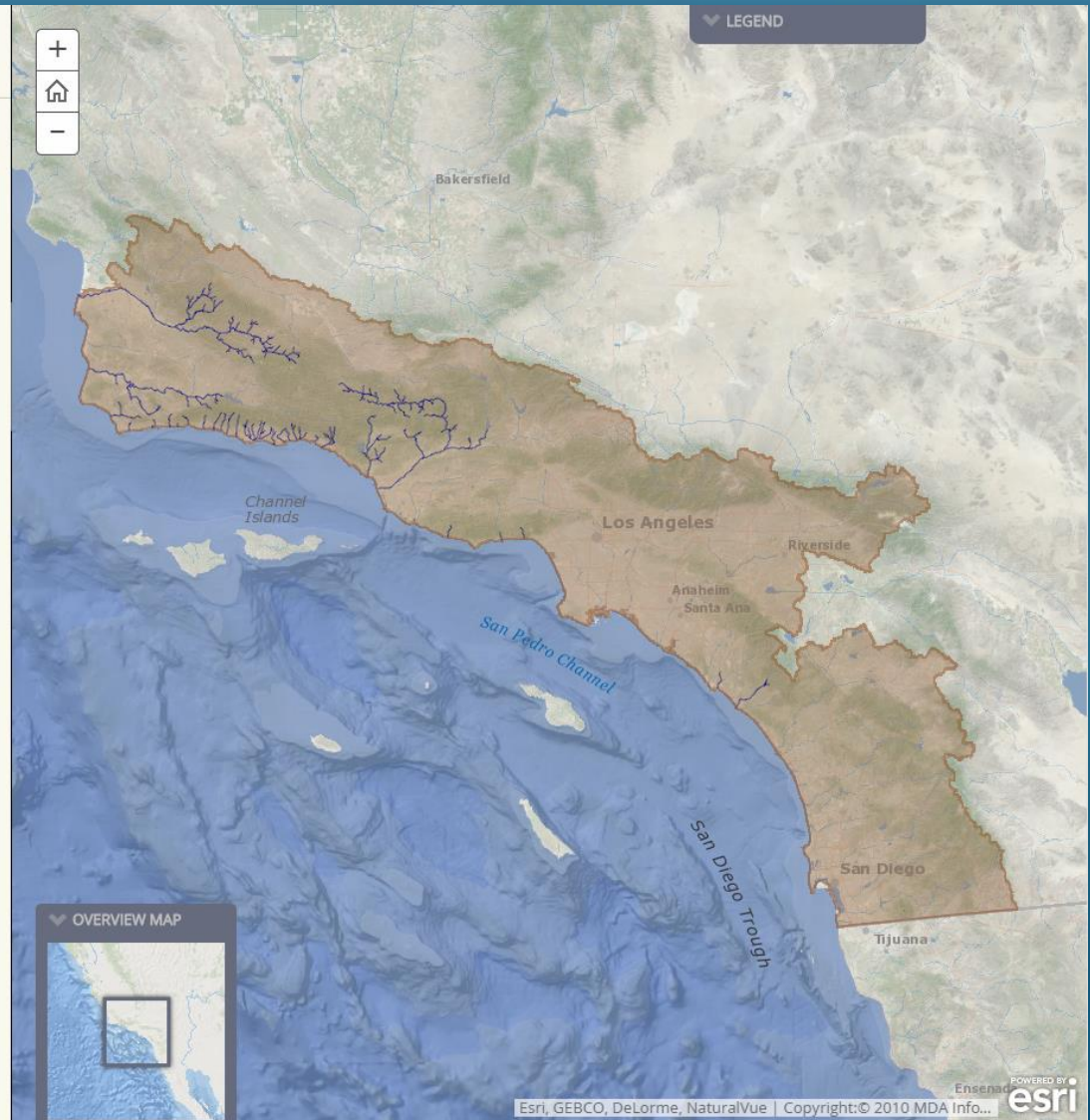
"Ventura River Steelhead Anglers, 1909" (NMFS's 2012 Southern California Steelhead Recovery Plan, page 5)

The map on the right shows the **historical distribution** of Southern California Steelhead populations.

Southern California steelhead can tolerate warm water and have a complex yet flexible life history that increases their resistance to environmental change. Steelhead are at risk of extinction, but restoring water quality and quantity, and removing or modifying man-made barriers to migration in certain Southern California streams would increase their chances of survival.

Present Day Southern California Steelhead Populations

Over the last 100 years the Southern California Steelhead population has declined 99% and some runs are extirpated. Southern California Steelhead are



Example of a Story Map about our Exhibits

an AOP story map



Southern California Steelhead

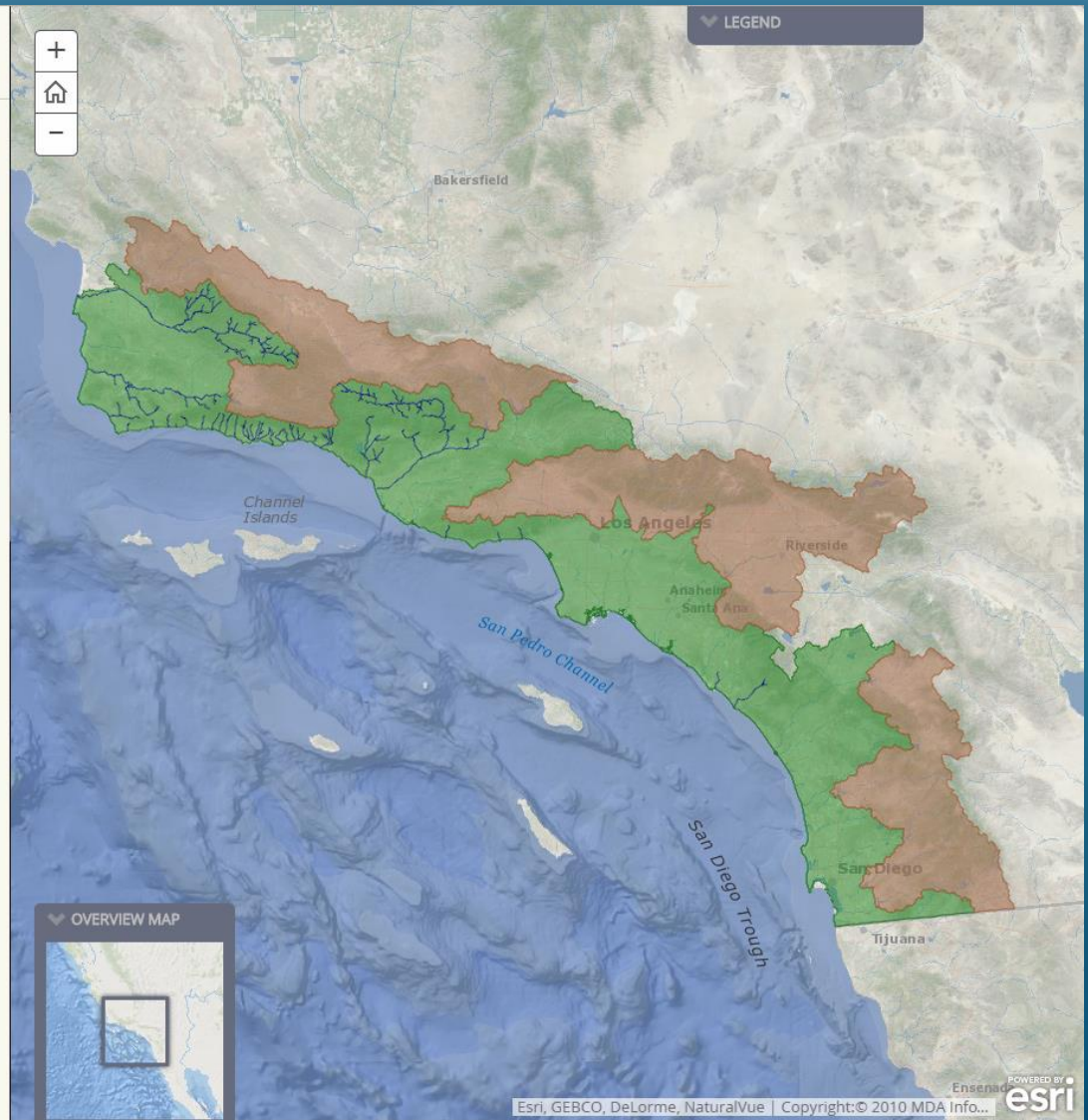
Present Day Southern California Steelhead Populations

Over the last 100 years the Southern California Steelhead population has declined 99% and some runs are extinct. Southern California Steelhead are now listed as endangered under the U.S. Endangered Species Act. The southern California population has declined from about 40,000 steelhead to less than 500. This decline was in large part the result of manmade infrastructure (like dams, concrete lined washes, etc).

The map on the right shows the **current steelhead population range**, the **historical range** which is now anthropogenically blocked, and the locations of **major dams**.



"Bradbury Dam, Santa Ynez River" (NMFS's 2012 Southern California Steelhead Recovery Plan, page 9)



Example of a Story Map about our Exhibits

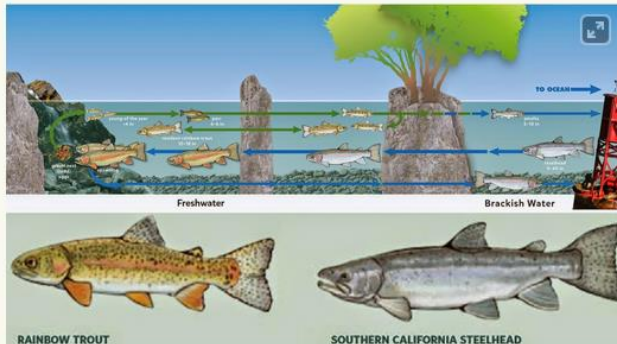
an AOP story map



Southern California Steelhead

At the Aquarium

The Aquarium's steelhead exhibit transports visitors along a mountain path, allowing them to view these fish in three areas, representing the species' journey from freshwater to brackish water, and finally to the ocean. Through this exhibit, the Aquarium hopes to reveal the secrets of a little-known fish that lives amongst us in our urban environment and inspire conservation of this unique animal.



Upper Elevation Habitats

The places where adults spawn, eggs hatch, and young fish develop (0-1 year).



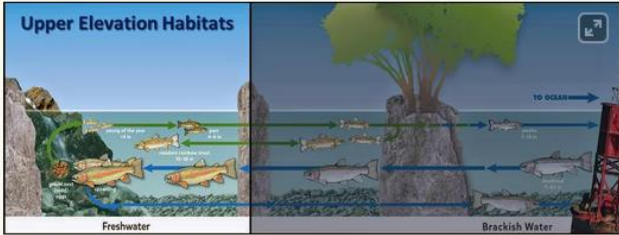
Example of a Story Map about our Exhibits

an AOP story map


Southern California Steelhead

Upper Elevation Habitats

The places where adults spawn, eggs hatch, and young fish develop (0-1 year).



The first segment of the Aquarium's steelhead exhibit represents the **Upper Elevation Habitats** and is filled with **juvenile rainbow trout** (< 4 inch long).



Mid-Elevation Habitats

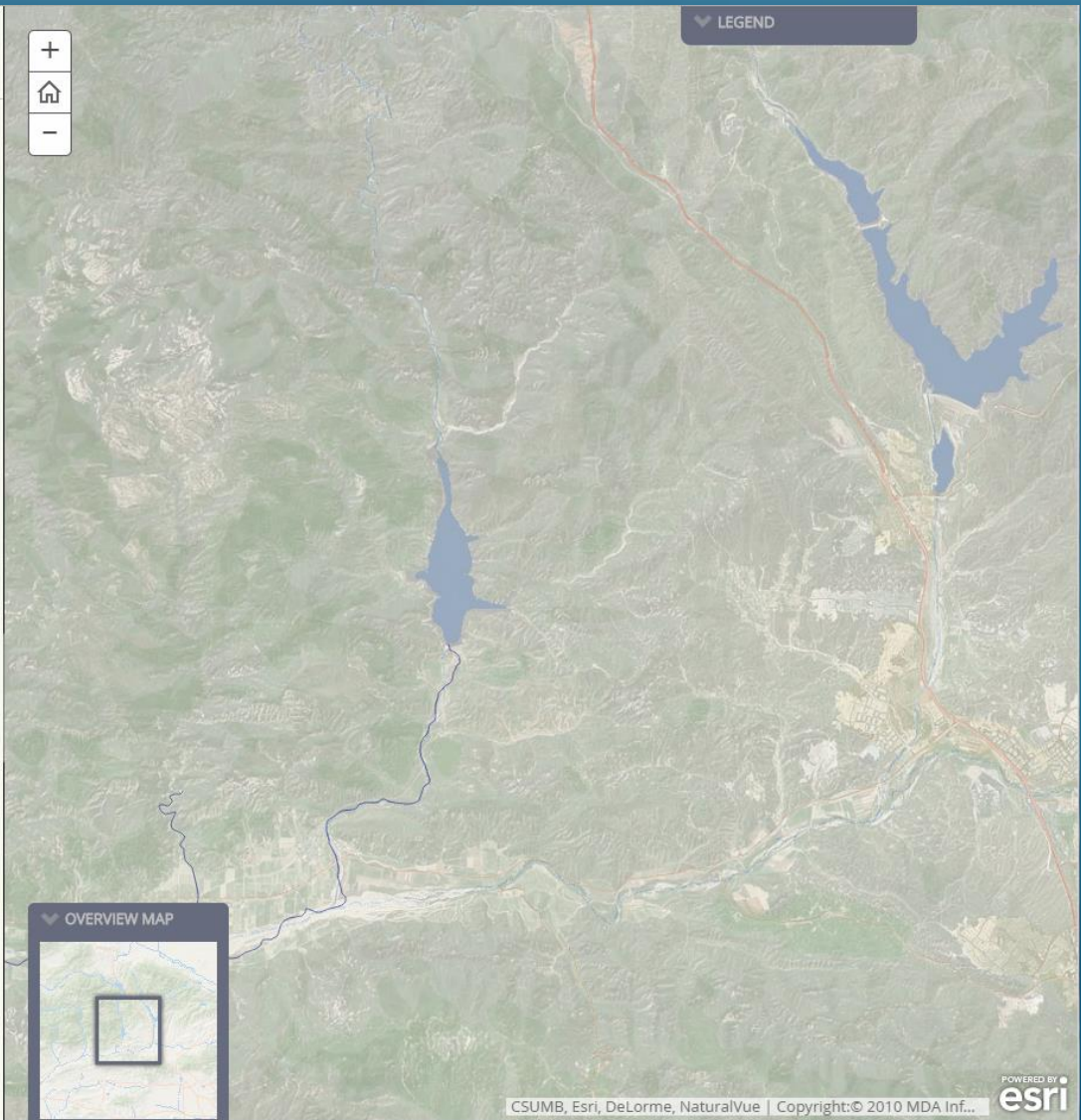
The places where young fish continue to grow. Some will stay in fresh water for life and remain as rainbow trout. Others will migrate to the ocean and become steelhead.

+


Home

-

LEGEND



OVERVIEW MAP



CSUMB, Esri, DeLorme, NaturalVue | Copyright: © 2010 MDA Inf... **esri**

Example of a Story Map about our Exhibits

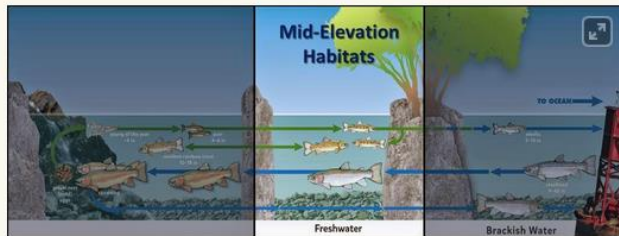
an AOP story map



Southern California Steelhead

Mid-Elevation Habitats

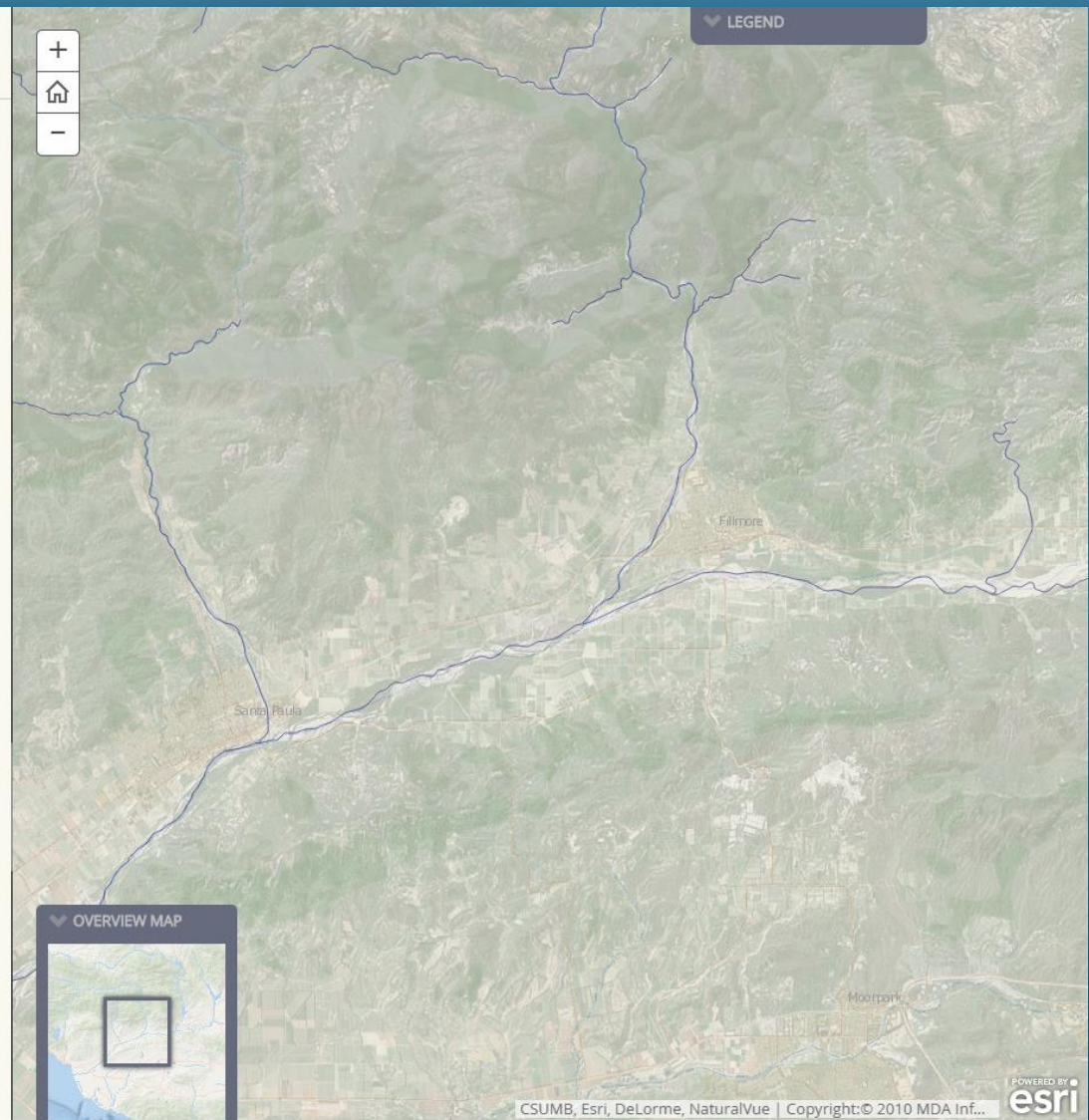
The places where young fish continue to grow. Some will stay in fresh water for life and remain as rainbow trout. Others will migrate to the ocean and become steelhead.



The middle segment of the Aquarium's steelhead exhibit represents the mid-elevation habitats and is filled with the resident rainbow trout (10-18 inch long)



Estuarine Habitats



Example of a Story Map about our Exhibits

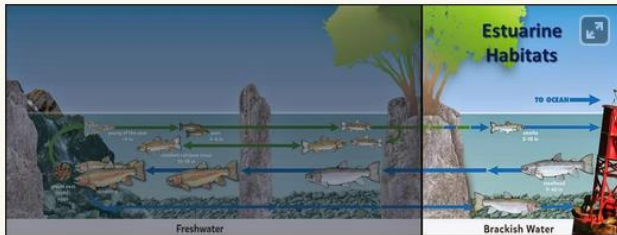
an AOP story map



Southern California Steelhead

Estuarine Habitats

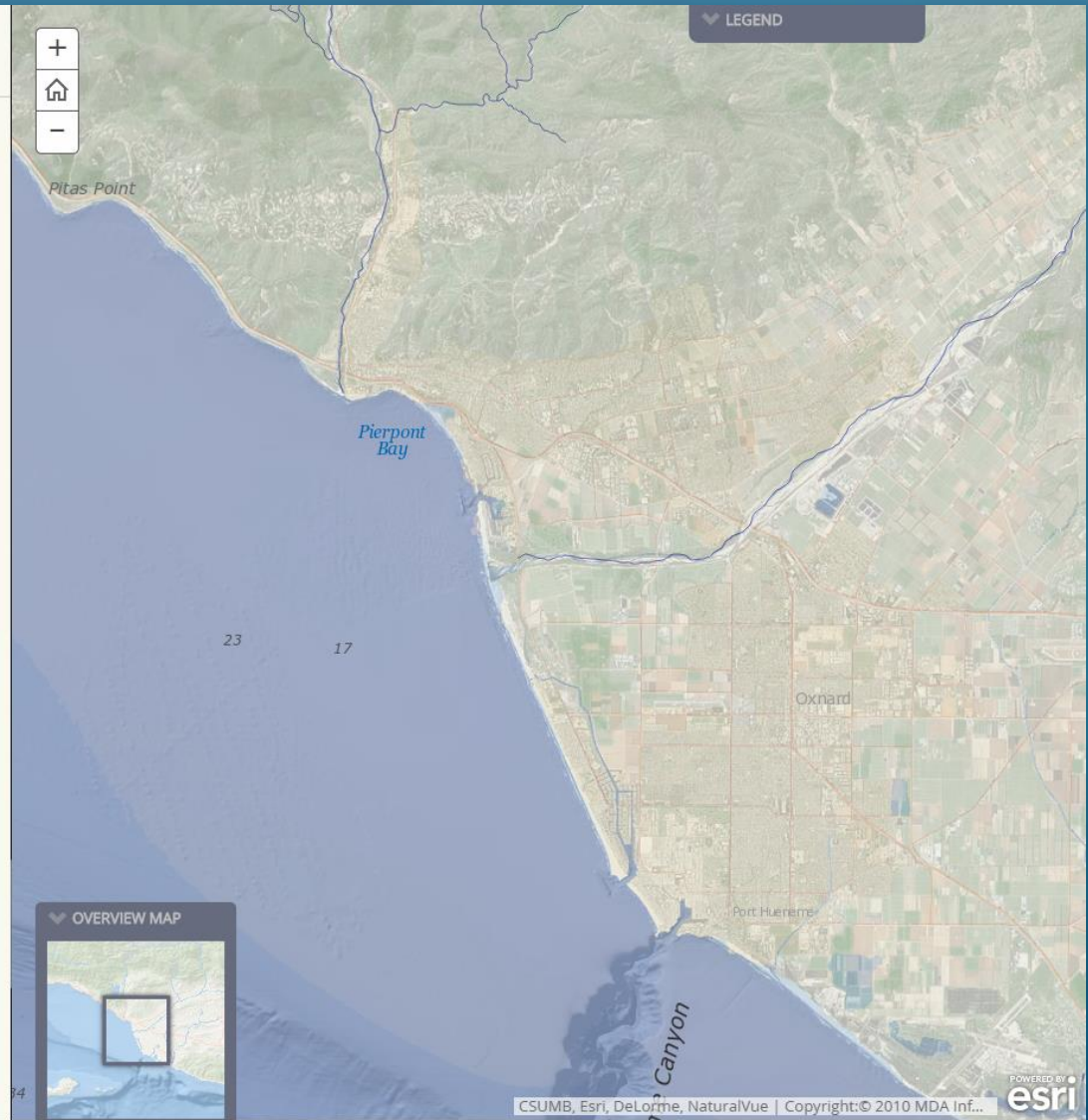
The places where most young fish grow and develop in preparation for their journey to the ocean where they become steelhead and the places to which they later return from the ocean on their way back upstream to spawn.



The last segment of the Aquarium's steelhead exhibit represents the estuarine habitats and is filled with the smolts (5-10 inch), which will hopefully turn into steelhead (9-40 inch) someday.



[Read More](#)



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Example of a Story Map about our Exhibits

an AOP story map



Southern California Steelhead

Steelhead

Historian John G. "Tom" Tomlinson, Jr., in collaboration with the Aquarium of the Pacific, has written a book documenting the local history of the Southern California Steelhead, including historic photos, postcards, fishery data, newspaper clippings, and rainfall statistics.

This book gathers historical information about this fish species and describes its resilience in the face of the region's changing watersheds, rainfall levels, and manmade infrastructure.

Against the Currents is available for sale in the Pacific Collections gift store or online at shop.aquariumofpacific.org

Learn More

Watch "Southern California Steelhead: Against All Odds" by California Trout



available online at: <http://vimeo.com/79393289>

More information about southern California Steelhead can be found online at:

- The Aquarium's Online Learning Center "Southern California Steelhead" page
- National Marine Fisheries Service (NMFS) Steelhead profile
- The Recovery Plan for Southern California Steelhead (Jan. 2012)

Learn More

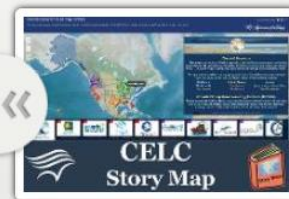
Example of a Story Map about an Issue / Topic

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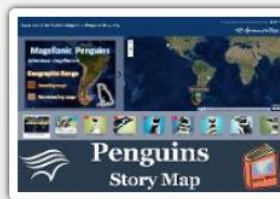
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Story Maps and other GIS-related projects



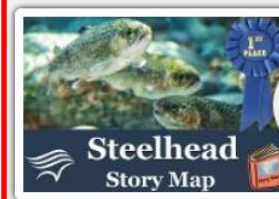
AOP's CELC Story Map



AOP's Magellanic Penguins Story Map



AOP's Seafood Story Map



AOP's Southern California Steelhead Story Map

The Aquarium of the Pacific's mission is to instill a sense of wonder, respect, and stewardship for the Pacific Ocean, its inhabitants, and ecosystems. Our vision is to create an aquarium dedicated to conserving and building Natural Capital (Nature and Nature's services) by building Social Capital (the interactions between and among peoples).

The Aquarium of the Pacific (AOP) is the fourth most-attended aquarium in the nation. It displays over 12,000 animals in more than 50 exhibits that represent the diversity of the Pacific Ocean. Each year more than 1.5 million people visit the Aquarium. Beyond its world-class animal exhibits, the Aquarium offers educational programs for people of all ages from hands-on activities to lectures by leading scientists. Through these programs and a variety of multimedia experiences, the Aquarium provides opportunities to delve deeper into ocean science and learn more about our planet. The Aquarium of the Pacific has redefined the modern aquarium. It is a community gathering place where diverse cultures and the arts are celebrated and a place where important topics facing our planet and our ocean are explored by scientists, policy-makers and stakeholders in the search for sustainable solutions.

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Example of a Story Map about an Issue / Topic

AN ...     Aquarium of the Pacific

Seafood Story Map

Feeding A Growing Population

More than 3 billion people around the world depend on seafood as their primary source of protein and for many of them, it is their only source. Seafood is becoming the healthy protein choice for billions of others and as our population increases, the demand for seafood is increasing even faster.

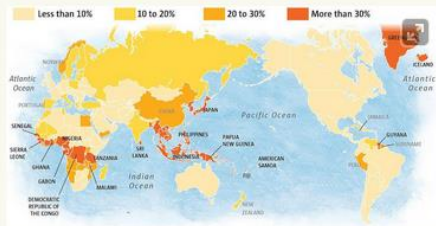


Image (above): "Dependence on Seafood Protein"
Seattle Times (2013) ["Sea Change: Food for Millions at Risk"](#) by Craig Welch. Data: Earthtrend Databased, World Resources Institute, and the Food and Agriculture Organization of the U. N.

How will we meet the growing demand?

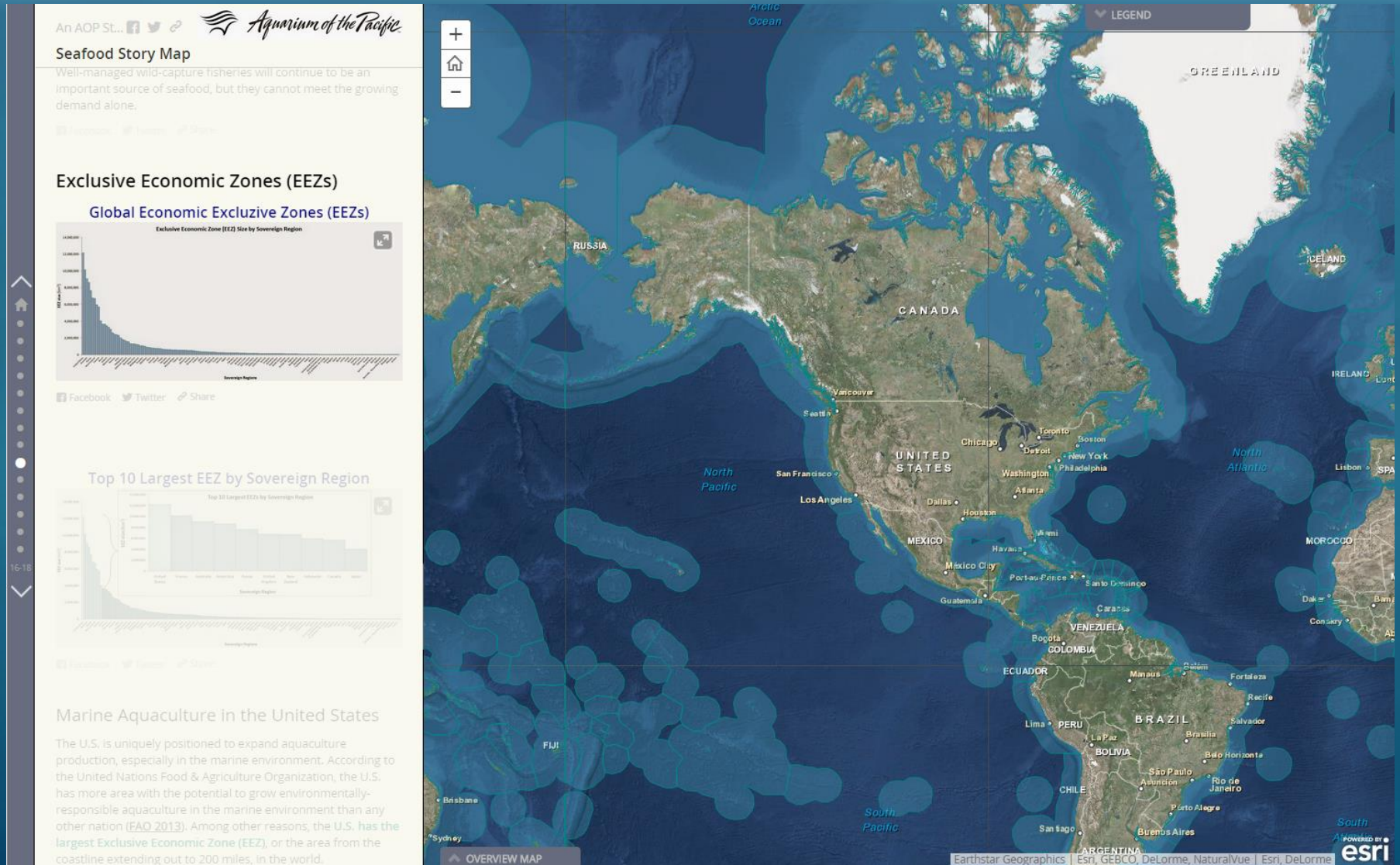
Seafood: Last Wild Food

Global Expansion

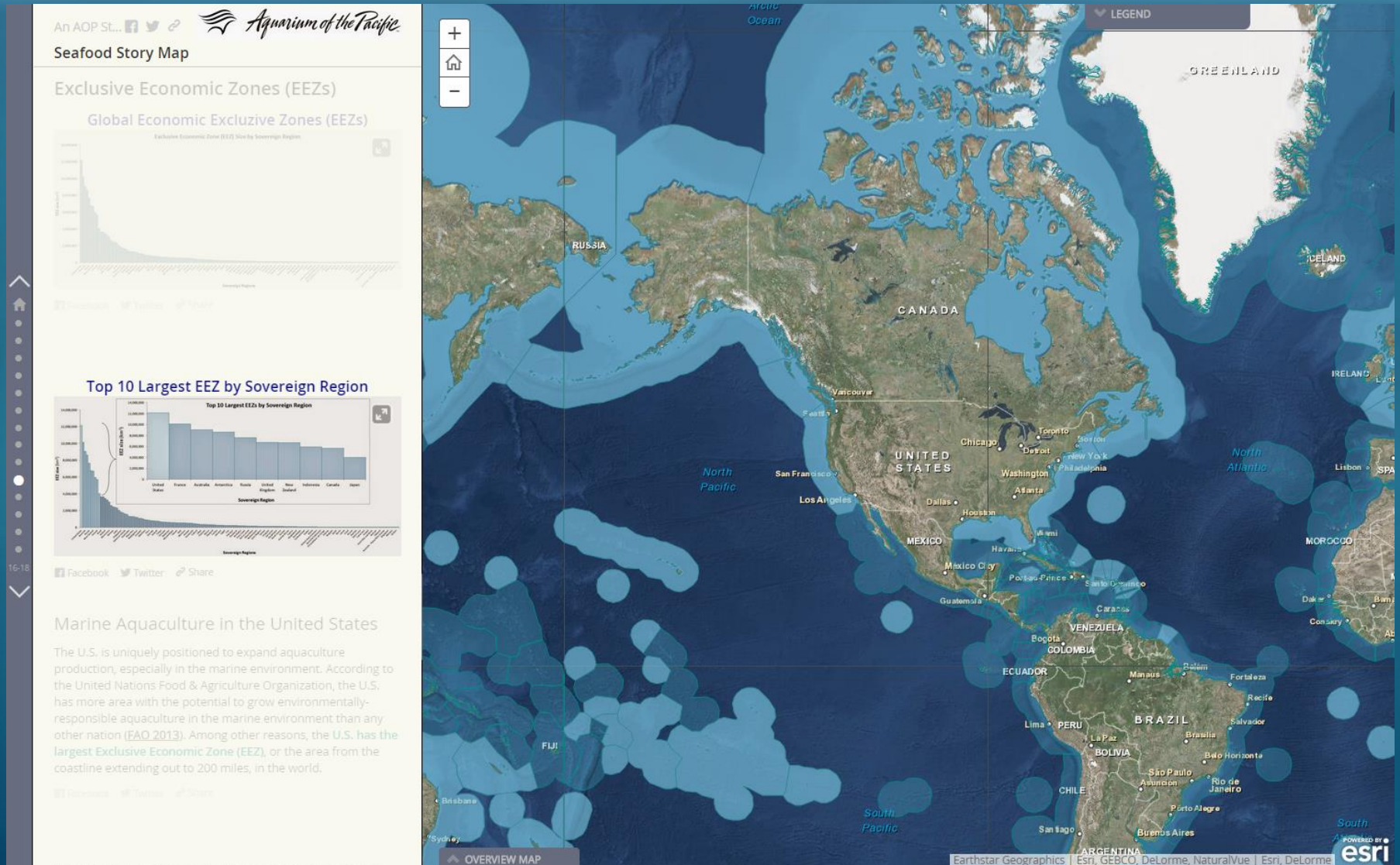
The global fish catch increased from less than 20 million tons per year in 1950 to over 90 million tons per year by the early-mid 1990s. The advancement of technologies such as GPS, refrigeration, and the use of tools such as







Example of a Story Map about an Issue / Topic



Example of a Story Map about an Issue / Topic




Example of a Story Map about an Issue / Topic

An Aquarium of the Pacific (AOP) story...    

Ocean Exploration


E/V Nautilus



The Exploration Vessel (E/V) Nautilus, is a 64-meter research vessel operated by the Ocean Exploration Trust

The Ocean Exploration Trust was founded in 2008 by Titanic-discoverer and National Geographic Explorer-in-Residence Dr. Robert Ballard to engage in pure ocean exploration.

Map of the 2014 Nautilus Expeditions




NAUTILUS 2014 FIELD SCHEDULE

Their international programs center on scientific exploration of the seafloor. In addition to conducting scientific research, their expeditions are made available to explorers on shore via live

NAUTILUS LIVE

Explore the ocean LIVE with Dr. Robert Ballard and the Corps of Exploration

MAIN THE EXPEDITION PHOTOS & VIDEOS THE TECH THE SCIENCE THE TEAM LATEST NEWS EDUCATORS JOIN US

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LATEST NEWS



Meet the Siphonophore



"Wrath of Khan" Worm Found in Mussels



The Future of Science: Exploring with Remote Telespresence



What Happens to Collected Samples?



Nautilus Doodles: Science Communication Through Art



Shrinking Cups in the Deep



OCEAN EXPLORATION TRUST



Google Earth



NAUTILUS 2014 FIELD SCHEDULE

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- **1. Create a FREE ArcGIS Online Organization Account**
by filling out this form: <https://esri.app.box.com/connectedrequest>



Request a Free US School Account X

Organization <input type="text" value="To select, begin typing."/>	Department <input type="text"/>
Street Address <input type="text"/>	City <input type="text"/>
State <input type="text" value="- Select -"/>	ZIP Code <input type="text"/>
School Website <input type="text"/>	School Phone <input type="text"/>
Contact First Name <input type="text"/>	Contact Last Name <input type="text"/>
Contact Email <input type="text"/>	<input type="checkbox"/> Agree to Terms and Conditions

- **2. Download & Install the “Snap2Map” App**

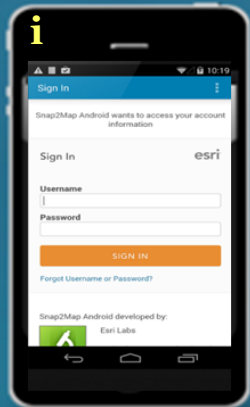


Create Your Own Story Map

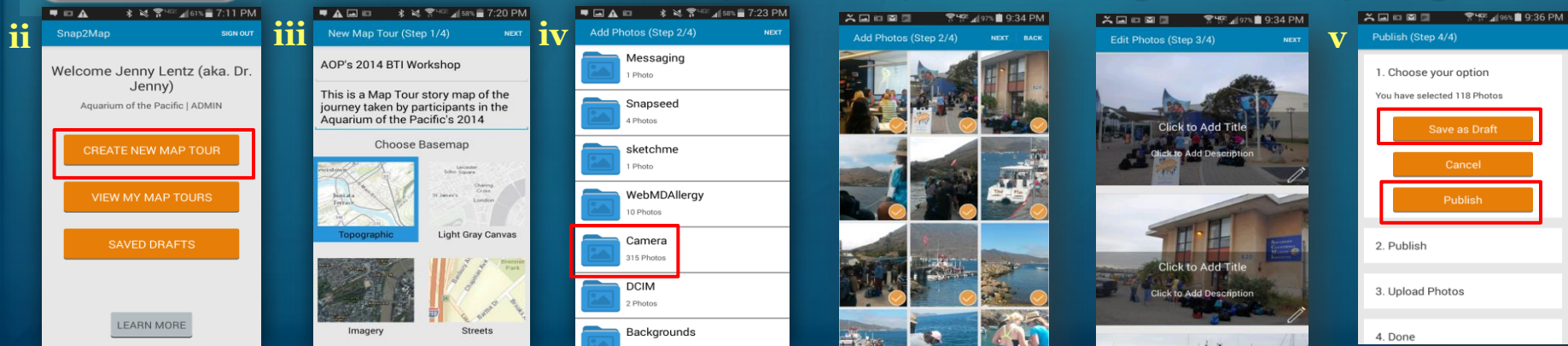
- 1. Create a FREE **ArcGIS Online Organization Account**
- 2. Download & Install the “**Snap2Map**” App
- **3. Collect Data on your Smart Device**
 - Make sure your smart-device’s **Location** settings are turned on
 - This includes making sure your **camera’s geotagging** feature is ON

Create Your Own Story Map

- 1. Create a **FREE ArcGIS Online Organization Account**
- 2. Download & Install the **“Snap2Map” App**
- 3. **Collect Data on your Smart Device**
- 4. **Open the Snap2Map App**








- i. Sign in to your ArcGIS Online Organization Account
- ii. Select **“Create New Map Tour”**
- iii. Fill in the **Title, Description**, & select a **Basemap**
- iv. Select the **folder & photos** to be included in your Story Map
- v. **Save and Publish** your newly created Map Tour Story Map!




BTI 2014 Map Tour Story Map

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Story Maps Website

Story Maps and other GIS-related projects




Penguins
Story Map

AOP's Magellanic Penguins Story Map




Steelhead
Story Map

AOP's Southern California Steelhead Story Map



The GREEN Aquarium
Story Map (working draft)

AOP, The GREEN Aquarium (working draft)



BTI 2014 Workshop
Story Map (working draft)

BTI 2014 Workshop (working draft)

The Aquarium of the Pacific's mission is to instill a sense of wonder, respect, and stewardship for the Pacific Ocean, its inhabitants, and ecosystems. Our vision is to create an aquarium dedicated to conserving and building Natural Capital (Nature and Nature's services) by building Social Capital (the interactions between and among peoples).

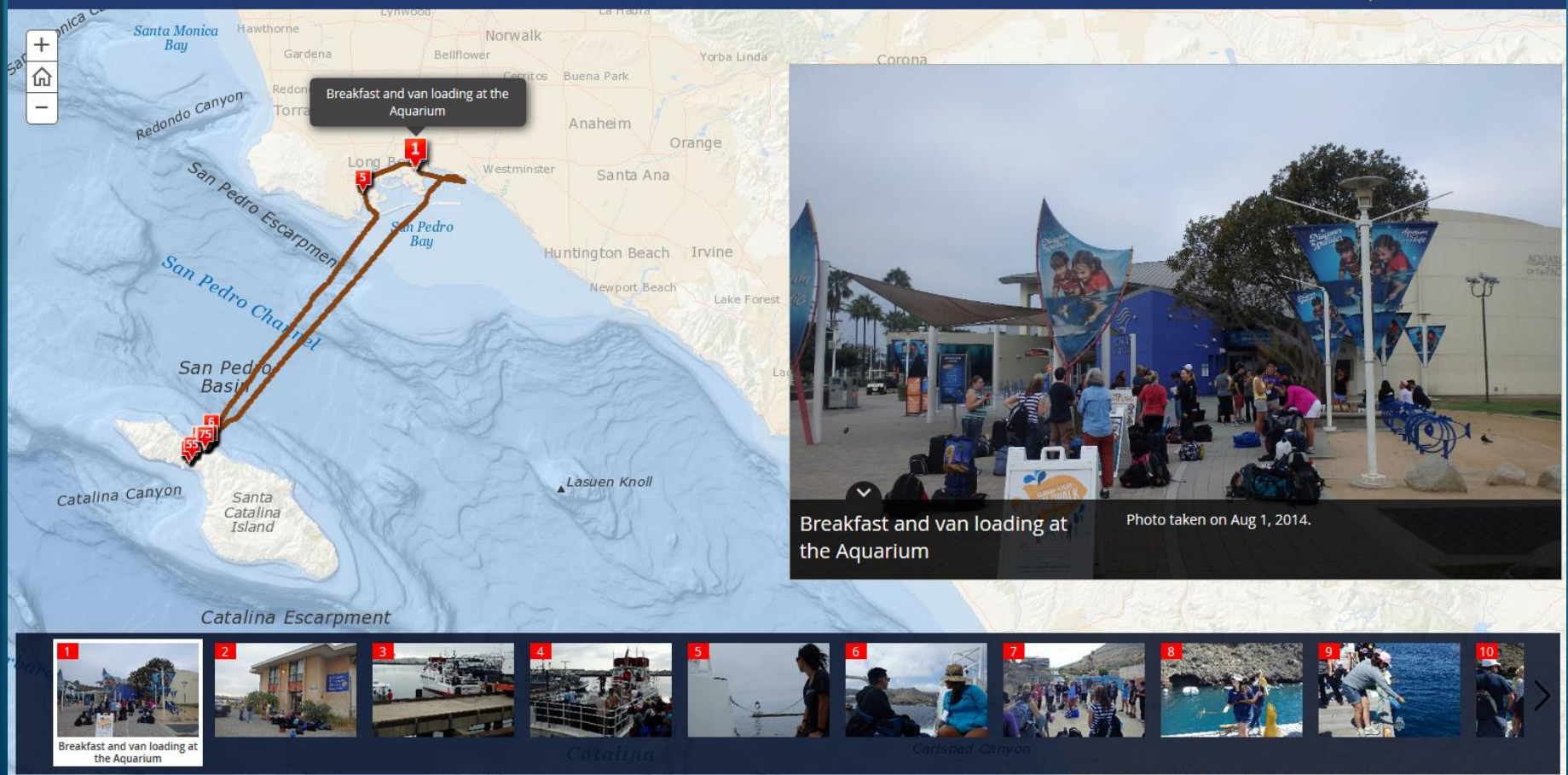
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BTI 2014 Map Tour Story Map

AOP's 2014 BTI Workshop

This is a Map Tour story map of the journey taken by participants in the Aquarium of the Pacific's 2014 Boeing Teacher Institute (BTI) Workshop

an AOP story map



Map Tour Story Map Tutorial

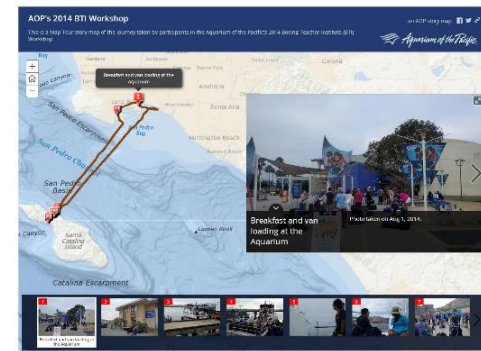
Story Map Tutorial and links FREE GIS Lesson Plans for K-12 Classrooms

available online at:

[http://JenniferALentz.info/
Teaching/Tutorials/
CreatingMapTourStoryMaps_2014.pdf](http://JenniferALentz.info/Teaching/Tutorials/CreatingMapTourStoryMaps_2014.pdf)

Creating “Map Tour” Story Maps

How to create a Map Tour Story Map quickly and easily using your smartphone or tablet, and your ArcGIS Online Organization Account



This Tutorial was Created by
Jennifer Anne Lentz, Ph.D.
Education Specialist at the Aquarium of the Pacific

*This tutorial, and other teaching-related materials by Dr. Lentz are available online at:
<http://jenniferALentz.info/Teaching.html>*

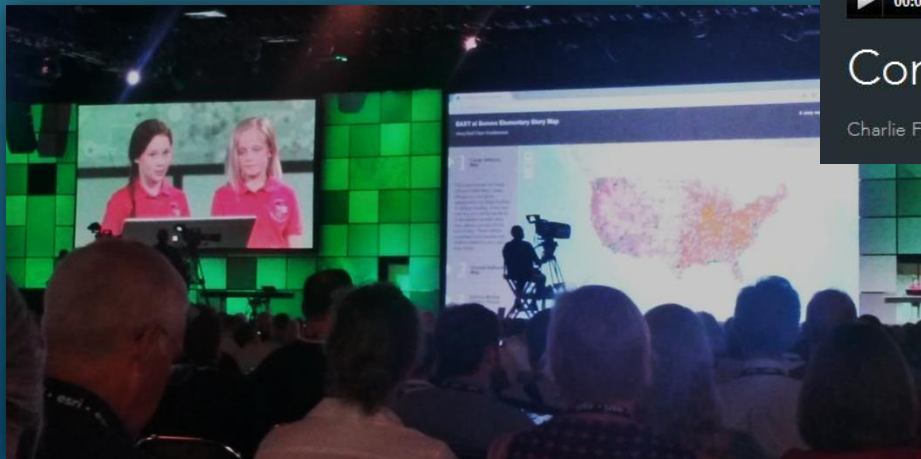
**This PowerPoint Presentation,
as well as other presentations and handouts are available online at:
<http://JenniferALentz.info/Teaching/>**

So Easy 4th Graders Can Do It!



Connecting GIS with Education

Charlie Fitzpatrick introduces the amazing work by students at Sonora Elementary in Springdale, Arkansas.



Watch Kylie & Rikki demo their GIS work
online at:

[http://video.esri.com/watch/3665/
connecting-gis-with-education](http://video.esri.com/watch/3665/connecting-gis-with-education)

“GIS Kids Are Super!” blog post (<http://blogs.esri.com/esri/ucinsider/2014/07/15/gis-kids-are-super/>)

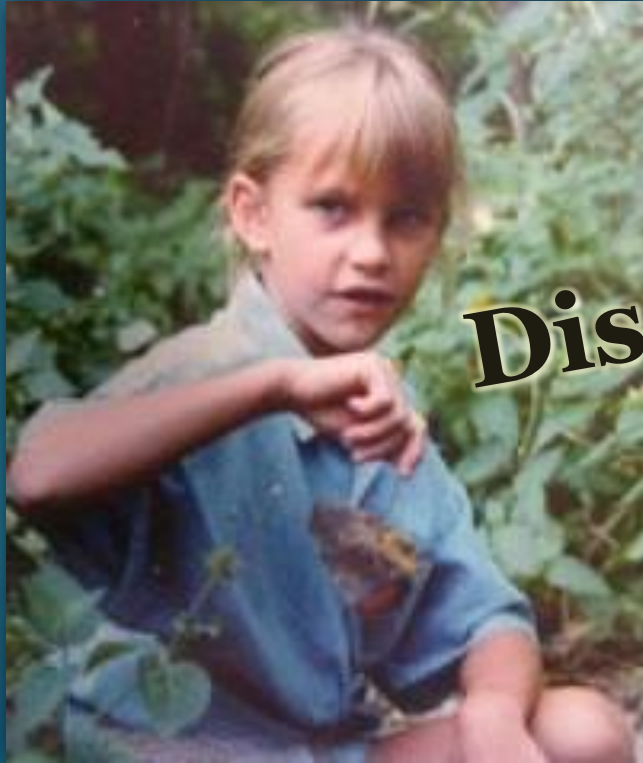
Connecting GIS with Education



<http://video.esri.com/watch/3665/connecting-gis-with-education>



My Background



Wonder

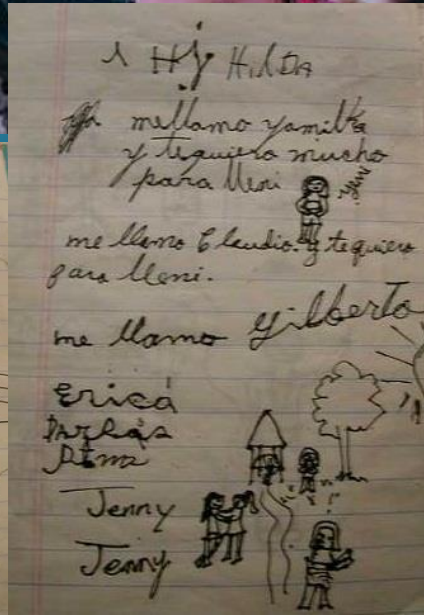
Discover

Learn

Explore



My Background



My Background

“Education Specialist” at the Aquarium of the Pacific



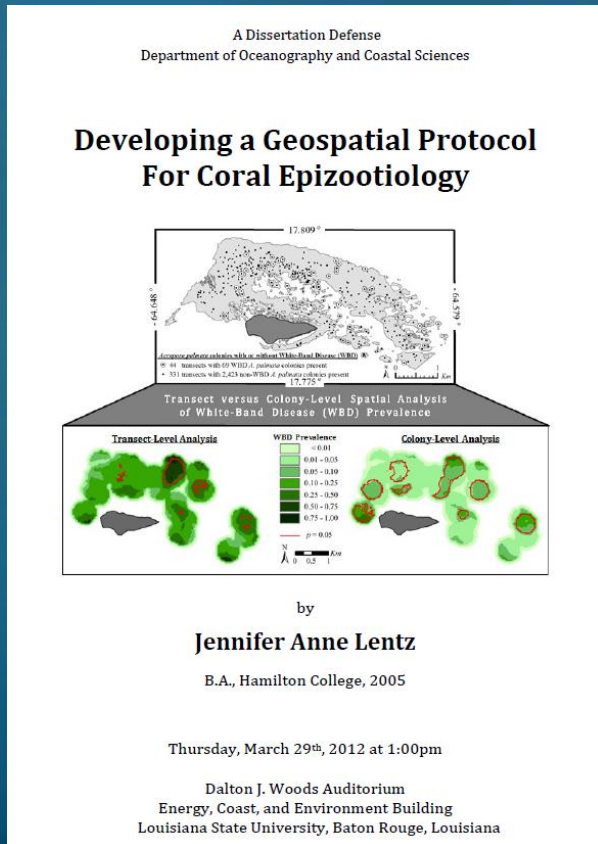
My Background

Bachelor of Arts (BA) degree from **Hamilton College**
with an Interdisciplinary Concentration in **Environmental Studies**

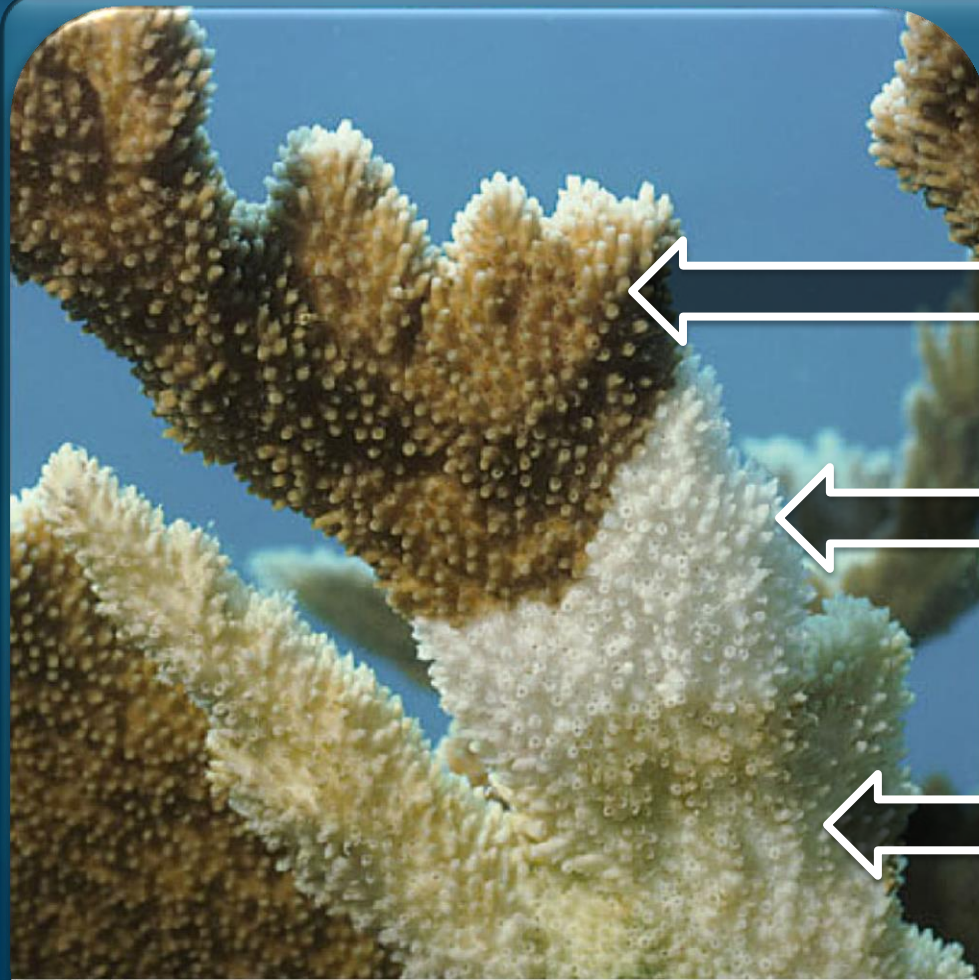


My Background

Ph.D. from **LSU's** Department of Oceanography and Coastal Sciences with a GIS Minor



Coral Reef Diseases



Healthy Tissue

Active WBD

**Recently Dead tissue
killed by WBD**

Fig.4.19: WBD; Caribbean *Acropora palmata* infected with WBD-I.
Sutherland et al, 2004

Coral Reef Diseases

95% decline in Caribbean *Acropora* corals

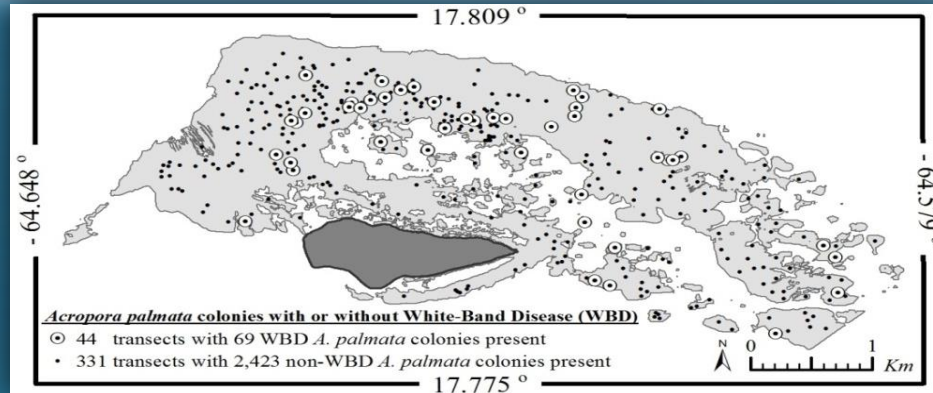
Past



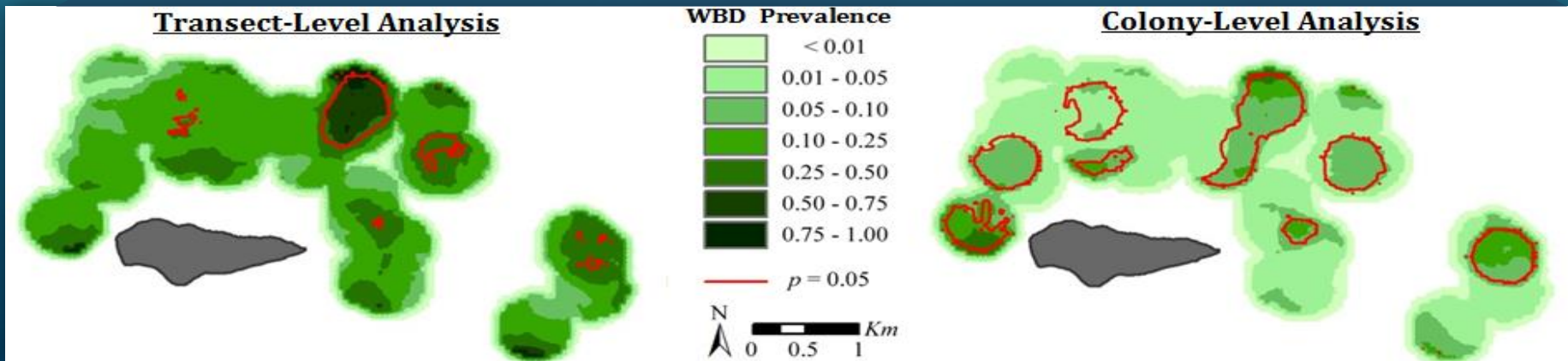
Present



Coral Reef Diseases



Transect versus Colony-Level Spatial Analysis of White-Band Disease (WBD) Prevalence



Home Range & Habitat Use

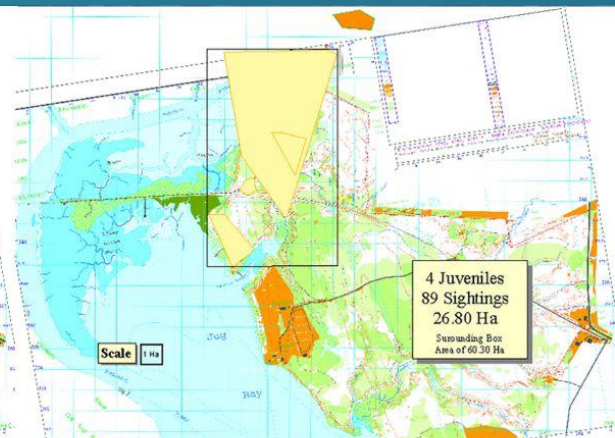
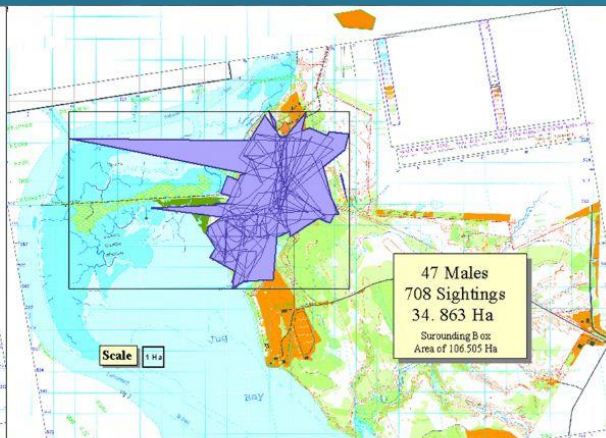
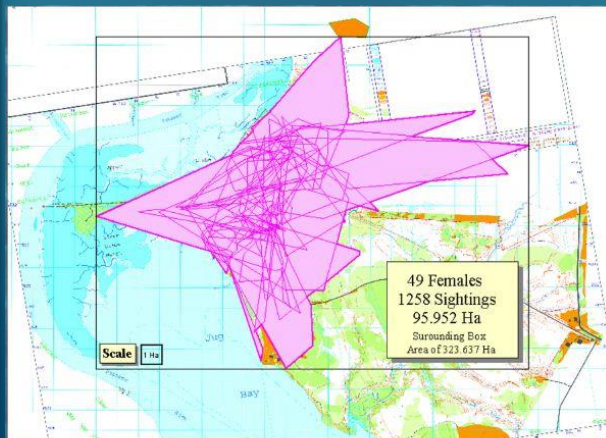


Fig. 6. Combined home ranges based on the Minimum Convex Polygon method. The home range of each individual turtle is depicted as a thin lined polygon; the total area used by each gender is depicted by a thick lined, shaded polygon.