Draft Submitted for Publication

Informational Readers Part 1: Web-based Story Maps in STEM
By Annette Lamb

As many schools are continuing distance learning or seeking new ways to engage stressed students, online informational reading experiences have become increasingly important tools for learning.

Story maps or StoryMaps are an immersive type of storytelling that use engaging text, maps, other visuals, video, animation and interactive elements to create narrative experiences.

For instance, **Innovative Uses of Storytelling During the COVID-19 Pandemic** <https://bit.ly/39XDtj4> features dozens of story maps demonstrating the power of combining text with interactive multimedia components. These interdisciplinary narratives examine topics such as the science of COVID-19, the logistics of testing, and the impact of the pandemic on mental health. Although designed for the general public, they're useful for educators helping students connect science concepts to today's real-world pandemic.

**INSERT FIGURE 1 HERE. COVID-19 Story Maps.

Story Maps in STEM Learning

Students get lots of experiences reading STEM related textbooks and learning packets. These instructional materials are focused specifically on STEM learning outcomes and designed for a specific reading level. However, most "real world" reading experiences beyond the school context involve short articles increasingly with interactive, multimedia elements.

Consider how a focused approach to selecting informational reading experiences can engage student readers. The selected story maps are designed for the general public, so reading level can be an issue for some students. Help learners apply informational reading strategies to increase their success.

Each of the following sixteen foci provide an engaging informational reading approach along with examples of story maps for students to enjoy.

1) Focus on Concepts

Some story maps are effective in teaching STEM concepts by combining captivating narratives with immersive interactive media. Seek out story maps that are directly tied to the STEM curriculum.

This is the author's manuscript of the article published in final edited form as:

Lamb, A. (2021, April). Informational Readers, Part 1: Web-Based Story Maps in STEM. Teacher Librarian, 48(4), 54–58.

What Causes Ocean Currents? <https://bit.ly/3gKLcSZ> takes students step-by-step through a series of experiences that explain the origins of ocean currents. The combination of animated maps and easy-to-understand text focuses learner attention on the key concepts.

2) Focus on Applications

Students often ask why they need to know a particular science concept or mathematics formula. How are these concepts applied in the "real world"? Story maps provide an engaging way to immerse learners in authentic narratives that demonstrate practical applications of STEM.

A Place for Birds <https://bit.ly/2LqLenz> traces the history and future of birds found at Petrified Forest National Park. It addresses the question "Why Study Birds?" through dozens of examples.

**INSERT FIGURE 2 HERE. A Place for Birds.

The 2019 Ridgecrest California, Earthquake Sequence <https://on.doi.gov/3qC4Tkt> summarizes the USGS response to the earthquake featuring fascinating maps, photographs, and data. Readers follow a group of geologists who responded to this natural disaster.

Avalanches on Going-to-the-Sun Road <https://bit.ly/3ng0u4J> examines the power of avalanches and their impact on a national park road.

Illuminating the Deep <https://bit.ly/2LuHEbV> examines how scientists are exploring the deepest reaches of the world's oceans. Readers are introduced to the men and women on the front lines of exploration.

In the Shadow of a Volcano <https://bit.ly/3ncePiq> tells a volcano's story from the perspective of the volcano, a community member, and a scientist.

**INSERT FIGURE 3 HERE. In the Shadow of a Volcano.

3) Focus on Examples

Examples are essential for learning. Students practice concepts they learn by exploring instances of the concept. Examples can provide a concrete experience for students who have a difficult time understanding abstract concepts. A unique or unusual example is likely to be remembered.

The Surprising State of Africa's Giraffes <https://bit.ly/3qLnL0m> shares a recent genetic study that suggests giraffes belong to four distinct species. The study of DNA can be complex. Make genetics concepts more understandable within the context of a beloved animal species.

**INSERT FIGURE 4 HERE. Africa's Giraffes.

A Fatal Illness with No Vaccine <https://bit.ly/3gxx2ED> tells the story of the contagious Chronic Wasting Disease and its impact on white-tailed deer, mule deer, elk, and moose. This real-world crisis helps students understand that science is constantly searching for solutions to medical problems.

Of All the Fish in the Sea: The Importance of Menhaden <https://bit.ly/37UXB2L> explores a specific type of fish. Use this story map to jumpstart an "The Importance of…" assignment asking youth to select a creature that needs more attention. In other words, have students create their own examples.

4) Focus on Virtual Adventures

Story maps can provide virtual adventures to locations around the world. Rather than simply reading about a place, story maps use maps, images, and media to immerse learners in a particular location. Whether exploring the Arctic expeditions or voyages on the high seas, maps help students feel a part of scientific discovery.

KAZAVA Project <https://bit.ly/3guyNCk> includes a collection of story maps exploring the plants, animals, and communities of a South African conservation area.

Charles Darwin and the Voyages of the HMS Beagle <https://bit.ly/2IeqYnP> follows the epic journey of the English naturalist and geologist as he explores the world.

**INSERT FIGURE 5 HERE. Charles Darwin.

Important Bird and Biodiversity Areas in Danger <https://bit.ly/2LEVQzj> explores priority natural areas that are in need of protection. Users zoom in to each site and learn about the issues and needs.

5) Focus on Comparison

Whether contrasting two species or observing changes over time, the skill of comparison is important across the STEM curriculum.

Glaciers in Alaska's National Parks <https://bit.ly/2p1Fb8I> demonstrates how glaciers are monitored to track changes. Ask youth to make their own comparison of the how glaciers are changing.

National Shoreline Change <https://bit.ly/3qKGU2k> shows how U.S. shorelines have changed over time. Ask youth to speculate on the future of these shorelines.

**INSERT FIGURE 6 HERE. National Shoreline Change.

(Farm) Animal Planet <https://arcg.is/1nPK8C> explores livestock around the world. Use this story map to make comparisons among the various types of livestock and their impact.

6) Focus on Citizen Science

In addition to seeing professionals at work, students are also interested in reading about how everyday citizens can play a role in meaningful science projects.

The Dragonfly Mercury Project <https://bit.ly/2VVH6O3> shares the citizen science framework used to monitor mercury pollution in national parks by collecting data about dragonfly larvae. Maps show sampling across the U.S.

**INSERT FIGURE 7 HERE. Dragonfly Mercury Project.

Beauty from Above <https://bit.ly/3nrE7Jt> is a citizen science mapping project using drone technology.

7) Focus on Action

Whether advocating for endangered animals or donating time to a conversation project, many story maps connect STEM with activism.

The Role of U.S. Coral Reefs in Coastal Protection <https://bit.ly/2IwIUKq> explores the importance of coral reefs and the need to protect them.

The Edges of (all) Life <https://bit.ly/37cr9K5> tracks key indicators in biodiversity's response to climate change. The project encourages readers to get involved.

The Benefits of Birds on the Farm <https://bit.ly/3gOpj5d> explores the important role birds can play on a farm and in pest management. Readers are encouraged to look for ways to support their local bird population.

**INSERT FIGURE 8 HERE. The Benefits of Birds on the Farm.

Hot Numbers <https://bit.ly/3nfoV2a> explores causes and consequences related to climate change. Ask youth to investigate one of the causes.

8) Focus on Real-world Events

Connect science with real-world events. Use interactive narratives to connect the science with the lives of people impacted by events such as natural disasters.

Earth's Biggest Storms: Tropical Cyclones <https://bit.ly/3qI4exM> explores the science and human impact of mega-storms.

9) Focus on Personalization

Seek out informational reading experiences that help youth personalize science concepts.

The Future of Farming <https://bit.ly/37TxsRK> shares the story of an Iowa farm family and their approach to farming.

10) Focus on Innovation

Young people enjoy learning about cutting edge technologies. They thirst for the newest ideas and examples of how the upcoming generations will make an impact on STEM.

A New Type of Coral Nursery <https://bit.ly/3gMKAfr> shares the engaging story of how scientists are restoring damaged reefs with new coral colonies.

The Bare Earth <https://bit.ly/3g9NniH> uses lidar technology to help readers see through layers of vegetation to discover the landscape.

11) Focus on Societal Connections

A number of STEM standards ask students to think about the consequences of human actions. These types of discussions require students to understand both the science involved along with societal connections.

The Human Reach <https://bit.ly/2VDWhvh> examines the planet-wide impact of humans. Weaving together maps, text, photographs, animations, and videos, it asks the question "At what point does the human demand on Earth outpace the planet's ability to support our species and those we live alongside…"?

**INSERT FIGURE 9 HERE. The Human Reach.

Living in the Age of Humans <https://bit.ly/3oD0EDg> is a four part exploration of the planet-wide impact of human activities.

12) Focus on Scientists and Practitioners

While your library is filled with engaging biographies, publishers often overlook lesser-known historical figures. Use story maps as a way to enrich your biography collection with captivating stories about scientists, scholars, and practitioners.

Discovery, Innovation and Hope <https://bit.ly/3oCGaun> describes the impact of Jane Goodall and her critical work in Gombe.

Susie Kin Taylor <https://bit.ly/2K61ppu> is a biographical story map featuring the life of an African American nurse and teacher during the Civil War era. The interactive story is based on a memoir Taylor published in 1902 about her experiences doing the war. Her story is brought to life through excerpts from her narrative, historical photographs, and other primary source materials.

Marie Tharp's Seafloor <https://bit.ly/3mjew4h> tells that story of a geophysicist involved in mapping the ocean's seafloor.

**INSERT FIGURE 10 HERE. Marie Tharp's Seafloor.

Mary Edward Walker <https://bit.ly/3lL8MzP> is the only female Medal of Honor recipient. A map-based story shares her life journey as a surgeon who volunteered for the Union Army.

Copernicus and his Universe <https://arcg.is/1zyTr4> examines the life of an astronomer who used science rather than religion to explain how the universe works.

13) Focus on Pairings

Use story maps as a bridge between online informational reading and more traditional novels and nonfiction books.

State of the Global Climate 2020 <https://bit.ly/33VTL8o> unpacks the seven indicators used to describe the global climate system. Pair it with **Imaginary Borders** by Xiuhtezcatl Martinez. This innovative short work is a call to action for those teens concerned about the disproportional image of climate change on communities of color. It's part of the Pocket Change Collective, a young adult nonfiction series focusing on activists and artists.

**INSERT FIGURE 11A HERE. State of Global Climate.
**INSERT FIGURE 11B HERE. Imaginary Borders by Xiuhtezcatl Martinez

Bee City USA <https://bit.ly/3m9jIay> explores ideas for bringing communities together to promote pollinators. Pair it with **Where Have All The Bees Gone? Pollinators in Crisis** by Rebecca Hirsch.

Mapping Mount Everest <https://bit.ly/3gFR2oC> follows a National Geographic project to map the famous mountain and **Race to Everest** <https://bit.ly/3mdc4Mt> tells the story

of historical expeditions. Pair these story maps with **Everest** by Sangma Francis for middle grade students or **The Everest Trilogy** realistic fiction novels by Gordon Korman.

14) Focus on Reluctant Readers

Use unusual approaches or multimedia features to entice students who would like to do anything but read.

Sound of the Wild West <https://bit.ly/3mY0tlD> is an audio tour of Montana's four major ecosystems. The combination of short narratives, visuals, and nature sounds will be engaging for even the most reluctant reader.

15) Focus on Collections

Students enjoy choice in their learning environment. Rather than assigning a particular story map, provide options for readers. This allows youth with the chance to share and compare their informational reading experiences.

National Geographic Explorer Stories Collection <https://bit.ly/3qOCOGE> can jumpstart an interest in STEM through learning about the work of scientists and conservationists. Students can choose from dozens of interactive stories originating from locations around the world.

An Ocean of Story Maps <https://bit.ly/3mbbIpP> contains three dozen story maps featuring a wide range of topics connected with the world's oceans. Ask each student to use a different story map as a starting point for their inquiry.

Other STEM story map collections:
NASA <https://go.nasa.gov/3oHBIuf>
National Park Service <https://bit.ly/3oGjitQ>
NOAA <https://bit.ly/2Kdz4gT>
USGS <https://on.doi.gov/2VWkUmW>

16) Focus on Lessons

An increasing number of story maps are available as part of larger units of instruction.

GeoInquiries <https://bit.ly/3nlOq1N> are short, inquiry-based activities that use map-based content as the anchor for standards-based lessons.

**INSERT FIGURE 12 HERE. Math GeoInquiry.

Hurricanes as Heat Engines <https://bit.ly/33YS0XO> is a story map designed to be used as part of a NASA lesson plan focusing on **Hurricanes** <https://go.nasa.gov/39YF3kO>. **NASA Story Map Lessons** <https://go.nasa.gov/3oHBIuf> explores a variety of topics.

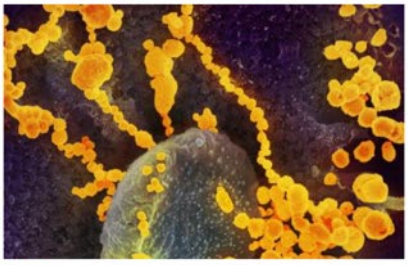
Story Maps as Informational Reading

Help youth practice authentic informational reading through the use of story maps. From government agencies like NOAA and NASA to non-profit environmental organizations and large corporations, story maps are being published by a wide range of developers for many purposes. As students explore these maps, they need to consider the perspective of the designer along with their intent. In other words, student readers need to evaluate the quality of information based on the purpose of the story map along with an understanding of the origin of the data used to build the story. For instance, some information-rich projects simply share the factual results of a grant project as part of a documentation requirement, while others may be seeking donations for a conservation project.

Story maps can be created using a wide range of web-based authoring tools. However, they've become popularized by Esri (Environmental Systems Research Institute), a producer of Geographic Information System (GIS) applications. **ArcGIS StoryMaps** <https://storymaps.arcgis.com/> are a web-based authoring tool for sharing maps along with narrative text and multimedia content. Although originally designed for creating geographic narratives, the tool has become popular across the curriculum. Educators and students can sign up for a free public account that limits advanced features, but works well for class projects.

Involving youth in creating their own story maps allows students the chance to think about the perspective of the author, selection of content, and purpose of sharing narratives. These experiences help students better understand issues of fact versus opinion and the differences in expository and persuasive writing.

1 Innovative uses of story maps during the COVID-19 pandemic



2 Mapping the novel coronavirus pandemic

3 How the Red Cross is Helping People During COVID-19

4 The GIS community responds to the COVID-19 crisis

5 CovidPulse

6 Segregation is Killing Us...

In the Shadow of a Volcano

Chapter 1 Chapter 2 Chapter 3 Chapter 4 Chapter 5 Chapter 6

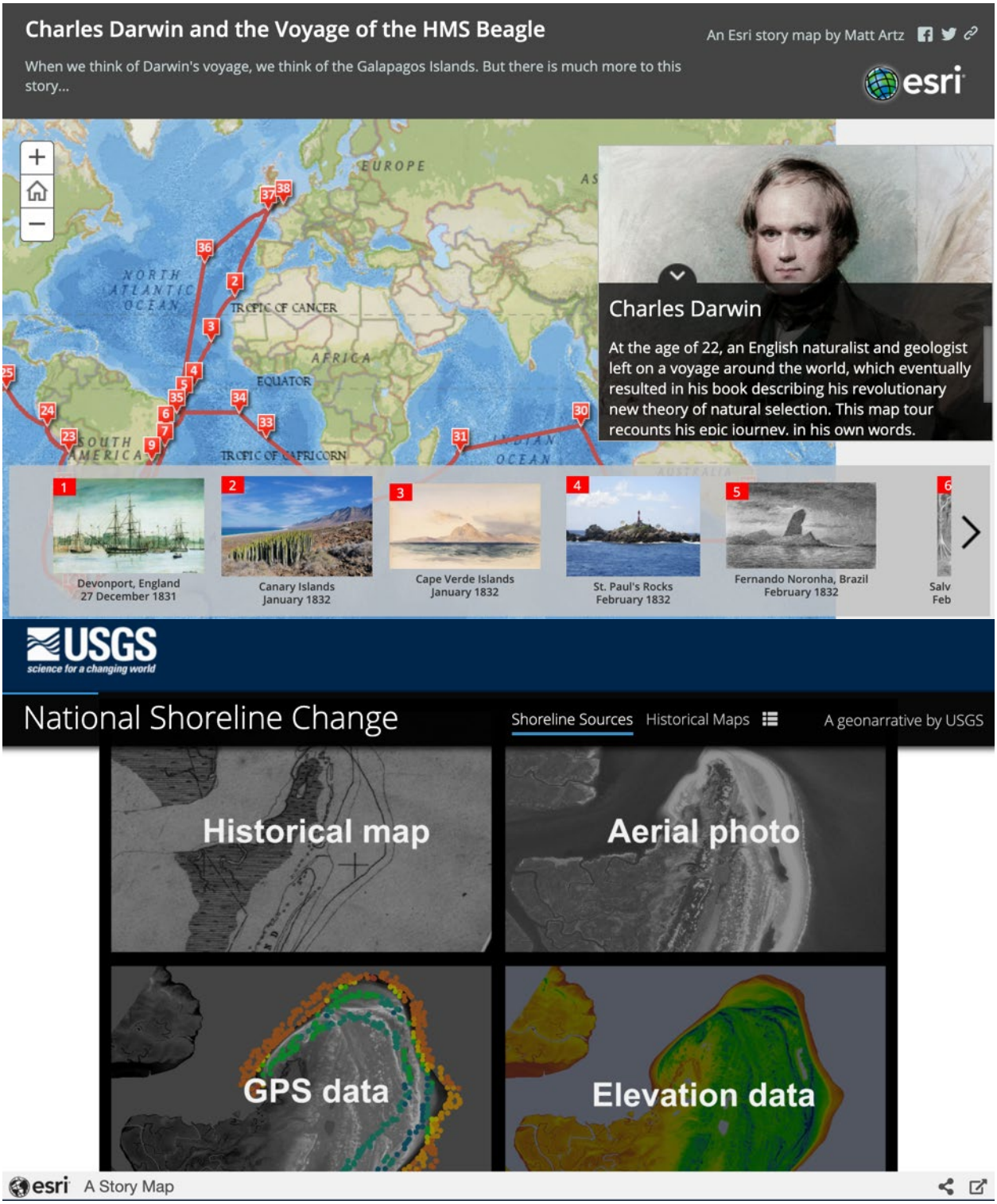
In 2017, a volcanologist, a photographer, and a cartographer traveled to Guatemala on a National Geographic-funded expedition.

Their goal was three-fold: to conduct innovative research that could help shape volcanic eruption warning systems; to create educational materials that explain the risks of living in the vicinity of a volcano; and to better understand what it is about these locations that is appealing enough for communities to remain there despite the risks.

The story below is based on the insights gained from this effort. It's told from the perspective of a volcano, a community member, and a scientist.

The Surprising State of Africa's Giraffes

A giraffe in Tanzania's Serengeti National Park. (Photo: Harshil Gudkta)


Charles Darwin and the Voyage of the HMS Beagle
An Esri story map by Matt Artz
When we think of Darwin's voyage, we think of the Galapagos Islands. But there is much more to this story...
esri
EUROPE
NORTH ATLANTIC OCEAN
TROPIC OF CANCER
AFRICA
EQUATOR
SOUTH AMERICA
TROPIC OF CAPRICORN
INDIAN OCEAN
AUSTRALIA
Charles Darwin
At the age of 22, an English naturalist and geologist left on a voyage around the world, which eventually resulted in his book describing his revolutionary new theory of natural selection. This map tour recounts his epic journey, in his own words.
1
Devonport, England
27 December 1831
2
Canary Islands
January 1832
3
Cape Verde Islands
January 1832
4
St. Paul's Rocks
February 1832
5
Fernando Noronha, Brazil
February 1832
6
Salv
Feb
USGS
science for a changing world
National Shoreline Change
Shoreline Sources
Historical Maps
A geonarrative by USGS
Historical map
Aerial photo
GPS data
Elevation data
esri A Story Map

USGS
science for a changing world

Benefits of Birds on the Farm

Wild Farm Alliance

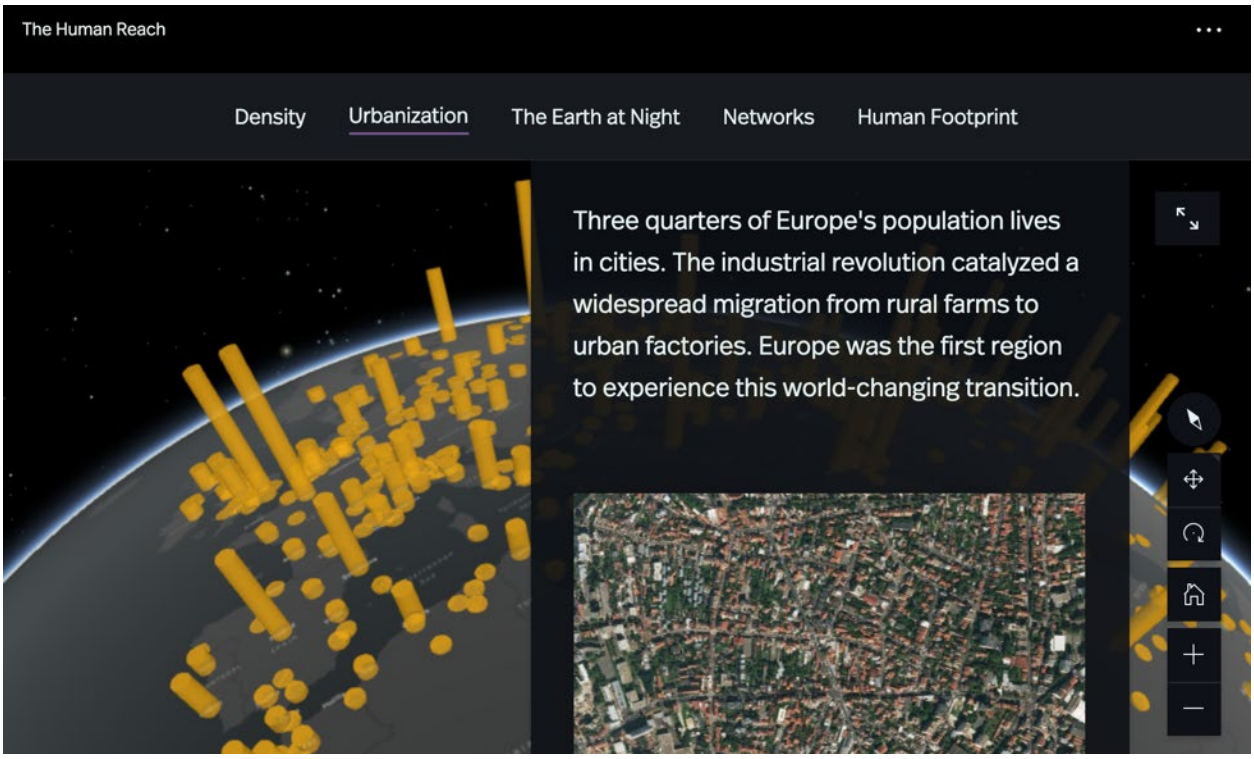
Introduction | Making the Case for Birds | Farmer Success Stories | Toolbox for Pest Management | Songbird Farm Trail

Toolbox

Make Your Farm More Bird-Friendly and Resilient

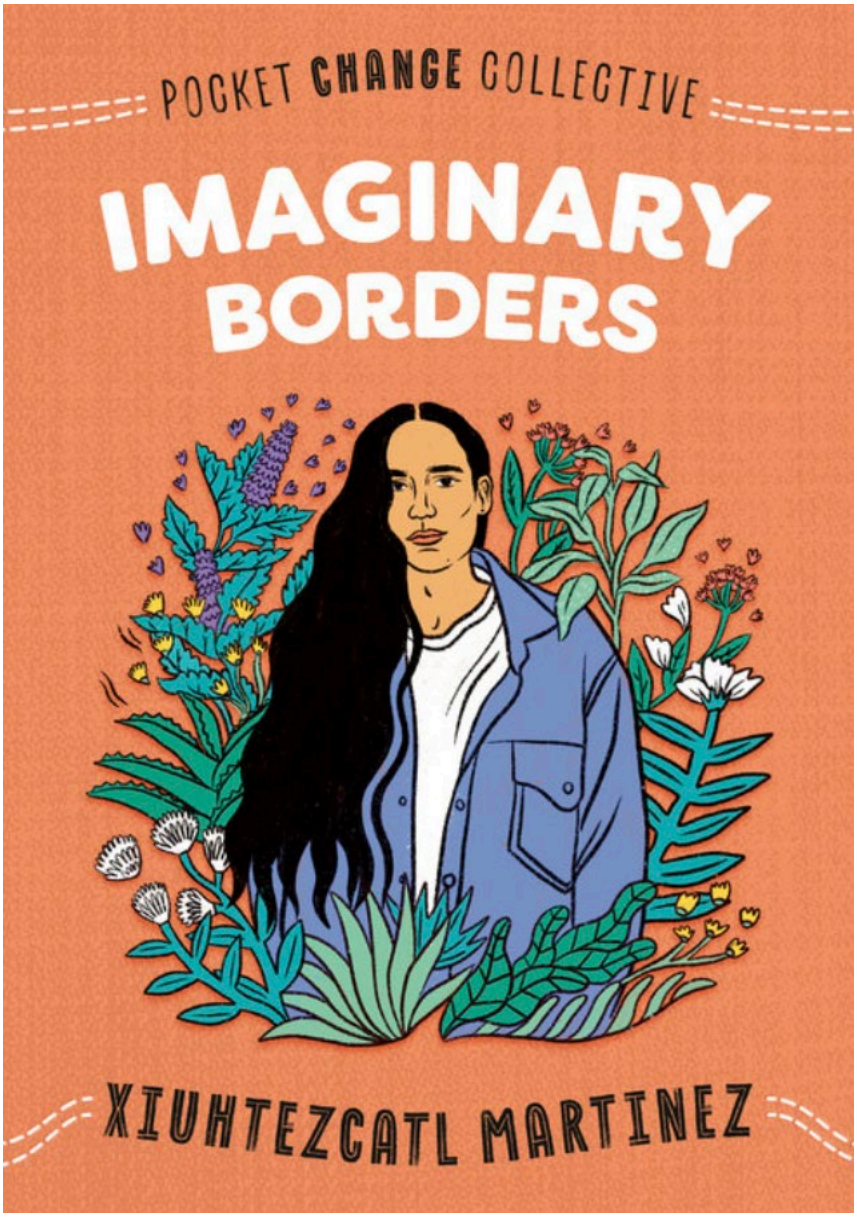
Put Up Nesting and Perching Structures

- Make Plans Early for Nest Boxes and Nest Platforms
- Barn Owl Nest Boxes
- Use Nesting Structures Tailored to the Birds You Want
- Provide Predator Protection
- Monitor Nest Boxes
- Raptor Perches
- Grow Sunflower and Sorghum



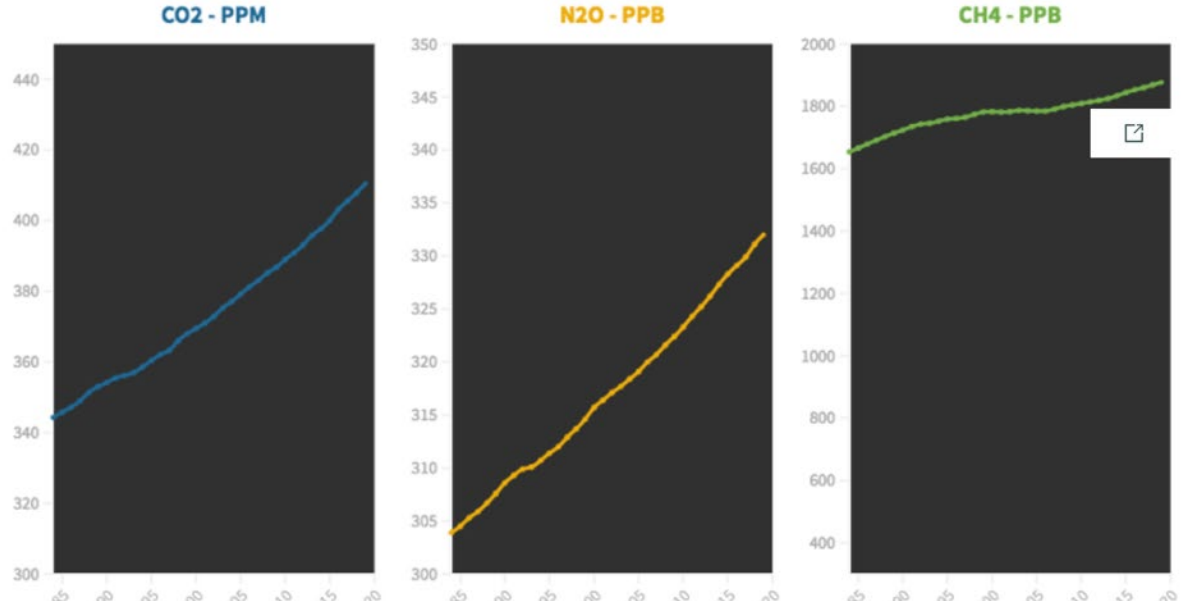
Marie Tharp's Seafloor

Marie Tharp began working at Columbia University in 1948, where she was a member of Maurice


POCKET CHANGE COLLECTIVE
IMAGINARY BORDERS
XIUHTEZCATL MARTINEZ

State of the Global Climate 2020 ...

Greenhouse Gases | The Big 3 | Why do greenhouse gases matter... | Ocean Acidification | T... →



MATH

Rates & proportions: A lost beach

from the Esri GeoInquiries™ collection for Mathematics

Target audience – Algebra learners **Time required – 15 minutes**

Activity	Determine the rate of coastal erosion by estimating changes in historical aerial photos.
Standards	**CCSS: Math.Content.HSF.LE.A.1.b.** Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. **CCSS: Math.Content.8.F.B.4.** Use functions to model relationships. **CCSS: Math.Content.8.EE.B.5.** Understand the connections between proportional relationships, lines, and linear equations.
Learning Outcomes	• Students will graphically model a proportional relationship, extending the graph to predict a future outcome.

Map URL: http://esriurl.com/mathGeoInquiry1

Engage

How is Timbalier Island changing?

- Read aloud: "Louisiana is washing away. Every hour, a football-sized area of land is being washed out to sea. Measuring the rate of coastal erosion is important to fishermen, oil and gas companies, and environmentalists. In this activity, we will, measure the erosion rate of Timbalier Island, a small island on Louisiana's coast."
- Click the link above to launch the map.