

Information Technology and Geoheritage

Digital Transformation of Geoheritage Sites



Damian Spangrud
Director of Solutions, Esri

Our World

Is Undergoing a Massive Digital Transformation

Blockchain

Lidar

Autonomous Vehicles

Digital Transformation

Drones

Augmented Reality

Manufacturing 4.0

Smart Cities

IoT

Smart Grid

Digital Twin

Artificial Intelligence

Big Data

The Geoheritage Landscape is Undergoing a Digital Transformation

Expanding the Impact and Transforming The Use



The Geoheritage Landscape is Undergoing a Digital Transformation

Expanding the Impact and Transforming The Use



Digital Transformation is Underway - Today

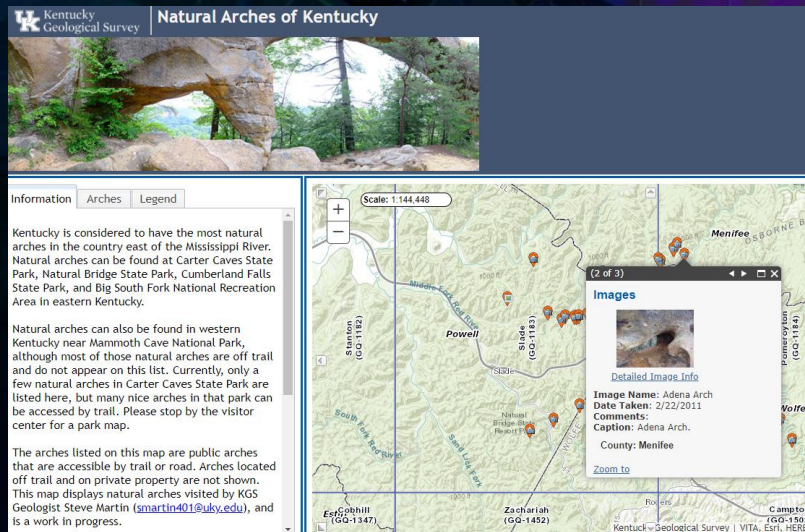
- Basic Digitalization Underway for quite sometime
- “Digital Natives” now on campuses and in organizations
 - Driving New Digital Innovation and Use
- Well positioned when COVID-19 lockdowns hit
 - COVID-19
 - Turned “Interesting” Digital Projects into “Must Have”
 - Spurred Innovation

The background is a complex collage of geometric shapes and data visualizations. It includes a network graph with purple nodes and lines on the left, a topographic map with blue and yellow dots in the top left, a 3D bar chart with purple bars on the top right, a colorful 3D terrain map in the bottom left, and a world map with red circles in the bottom right. The text is centered in a white, bold, sans-serif font.

An Explosion of Innovation Around Geoheritage Sites

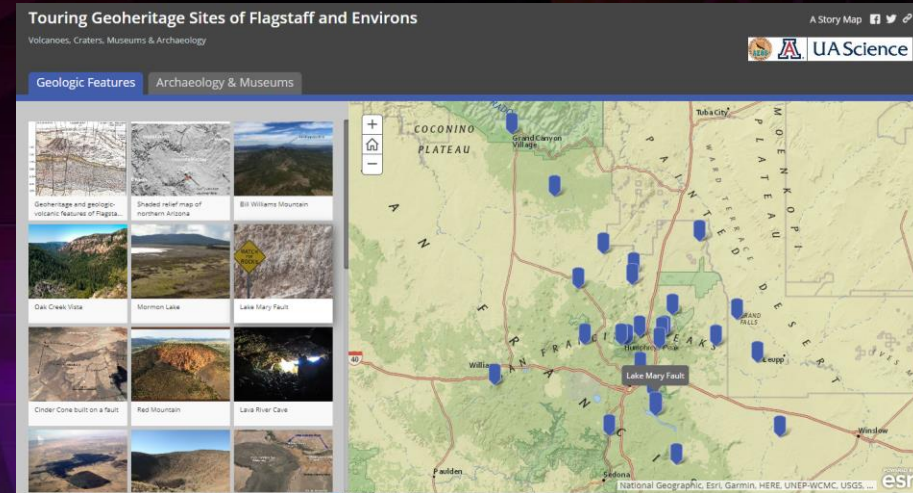
Geoheritage Tours

Tour of Natural Arches



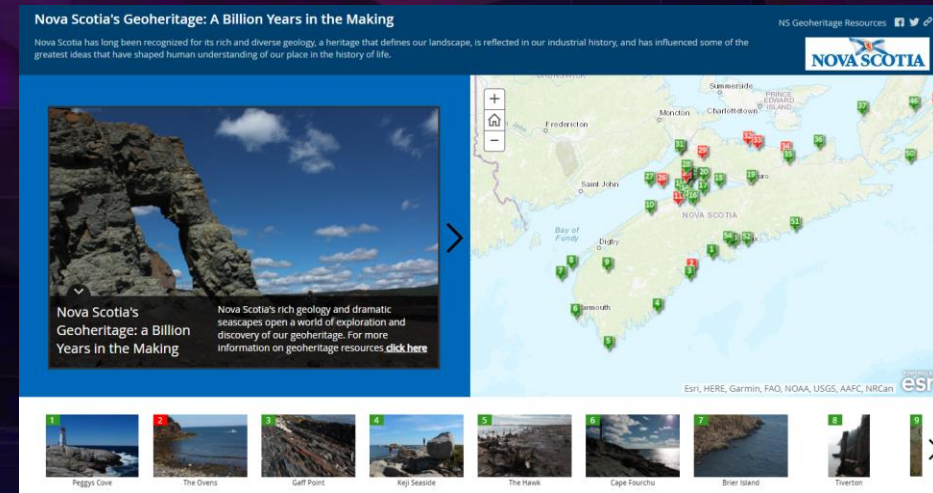
University of Kentucky
<https://kgs.uky.edu/arches/>

Tour of Geoheritage Sites



University of Arizona
<https://uagis.maps.arcgis.com/apps/Shortlist/index.html?appid=fdc21ae7afe74716830194bd466f268a>

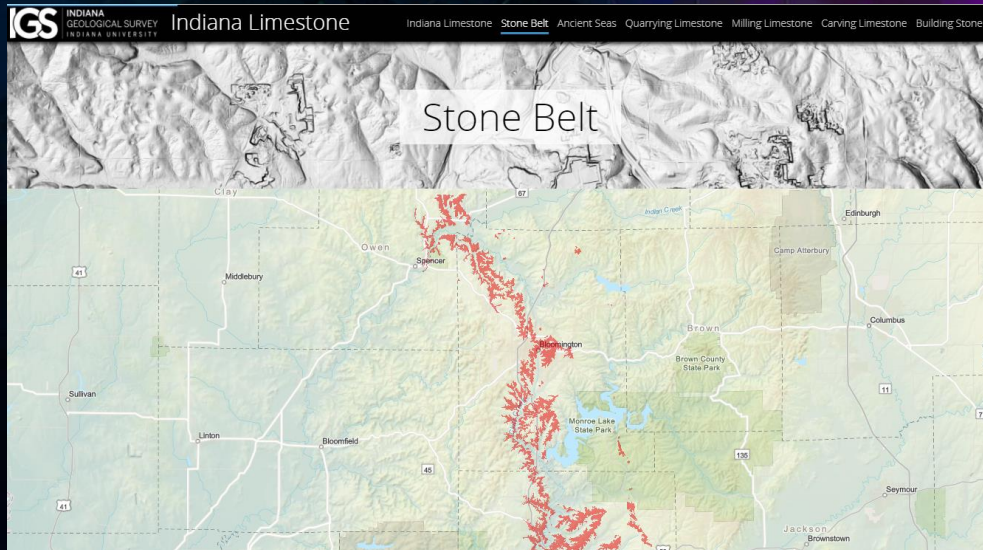
Tour of Geoheritage Sites



Geoscience & Mines Branch, Nova Scotia, Canada
https://fletcher.novascotia.ca/geoheritage_ns_tour/index.html

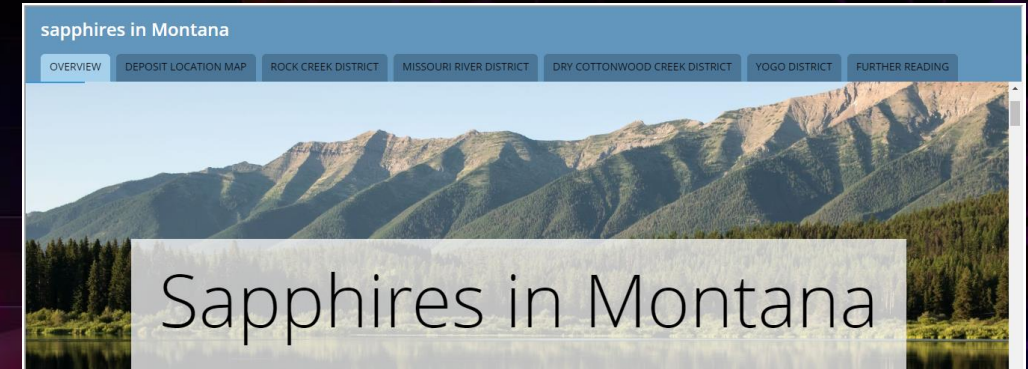
Landscape Exploration

Limestone Sources in Indiana



Indiana Geological Survey
<https://igsmap.maps.arcgis.com/apps/Cascade/index.html?appid=b9ec967ce39a49cd8de6fd24aa14d477>

Sapphires in MT



Montana Bureau of Mines and Geology
<https://www.mbmgt.mtech.edu/Information/Storymaps/sapphirestorymap.asp>

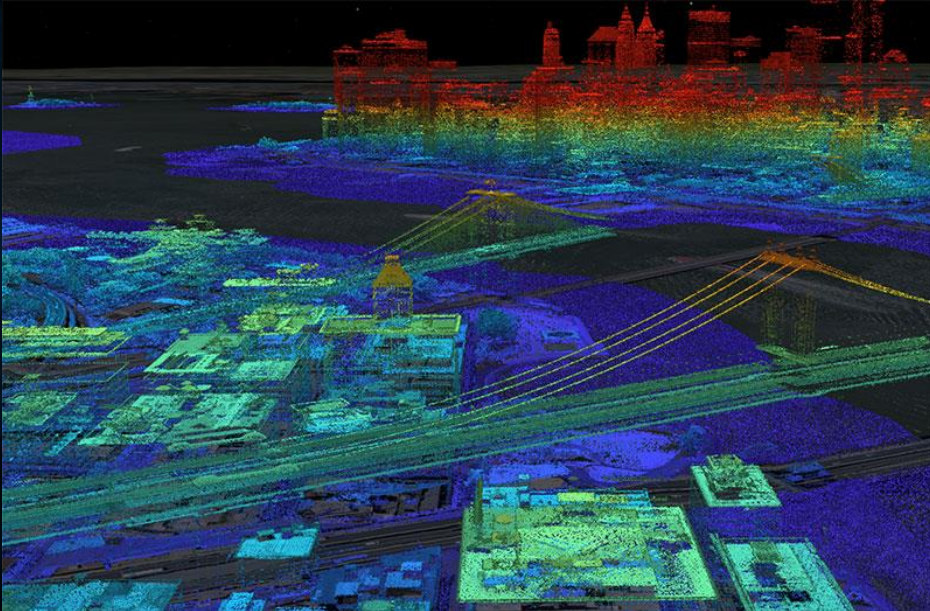
San Francisco Volcanic Field, AZ



University of Arizona
<https://uagis.maps.arcgis.com/apps/MapSeries/index.html?appid=4bdb7afed5a649df98789cad92348ec8>

Incorporating 3D Landscapes

Lidar



NYC DOITT

<https://maps.nyc.gov/lidar/2017/>

3D Exploration



3D LiDAR Point Cloud StoryMap

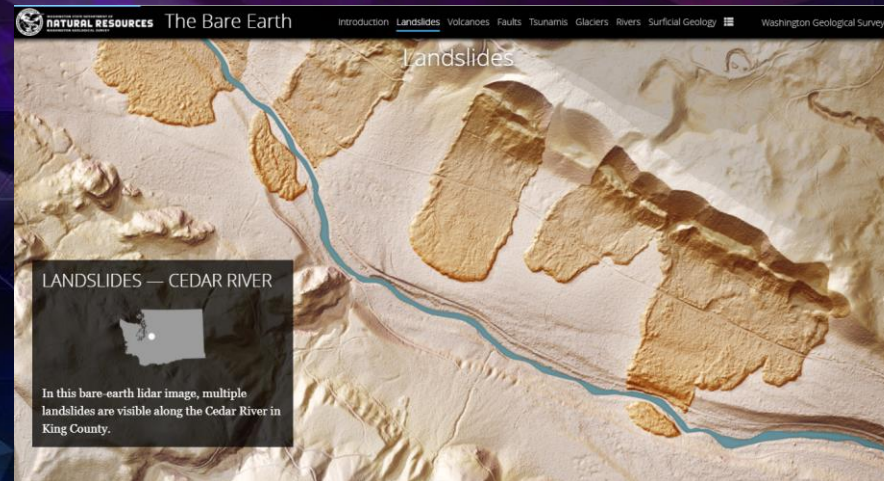
A StoryMap about the web application in Manitowoc County

Manitowoc County, Wisconsin

Manitowoc County, WI

<https://storymaps.arcgis.com/stories/d37d8a3d0d1e49579dce031be8aa36d9>

Landslides

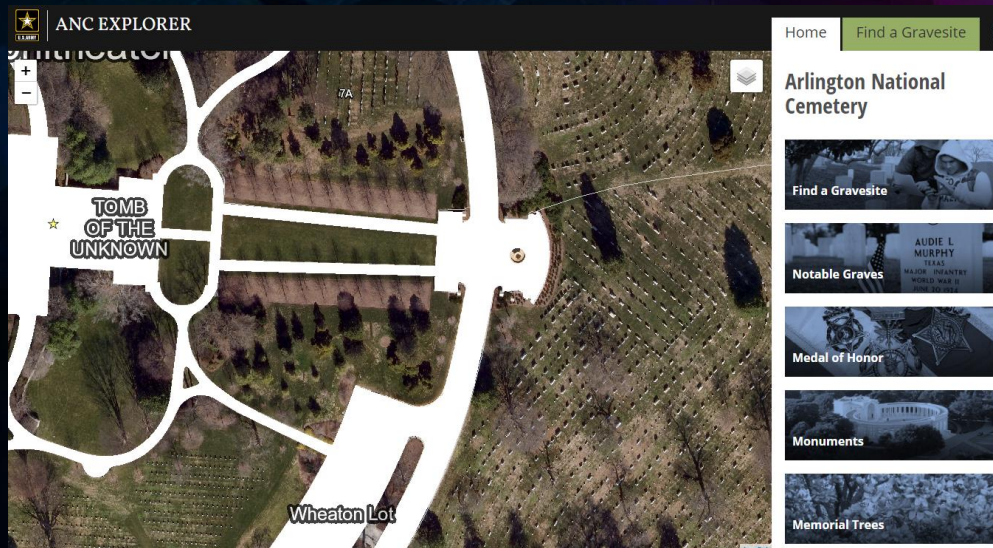


Washington State DNR

<https://www.arcgis.com/apps/Cascade/index.html?appid=36b4887370d141fcbb35392f996c82d9>

Cultural Exploration

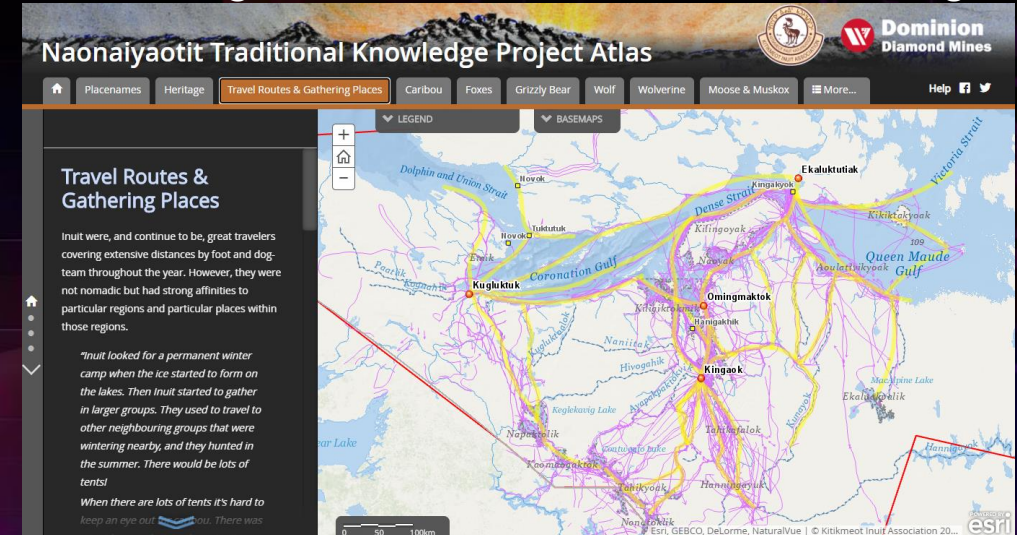
Understanding Cultural Landscapes



Arlington National Cemetery

<https://ancexplorer.army.mil/publicwmmv/#/arlington-national/>

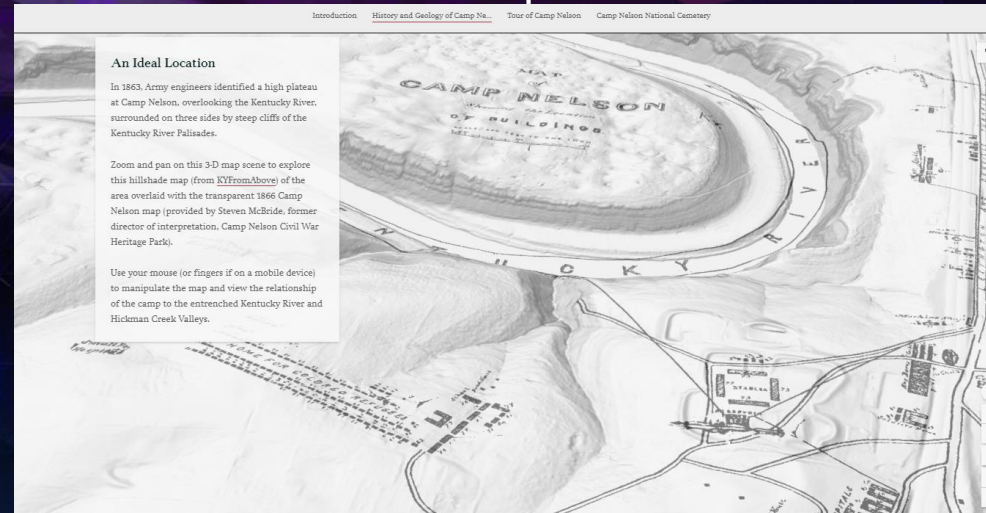
Preserving and Share First Nation Knowledge



Kitikmeot Inuit Association (KitIA)

<https://www.ntkp.ca/>

Historical Context: Camp Nelson National Monument



Kentucky Geological Survey

<https://storymaps.arcgis.com/stories/a998ea07070543e6a7acda28a219bd4e>

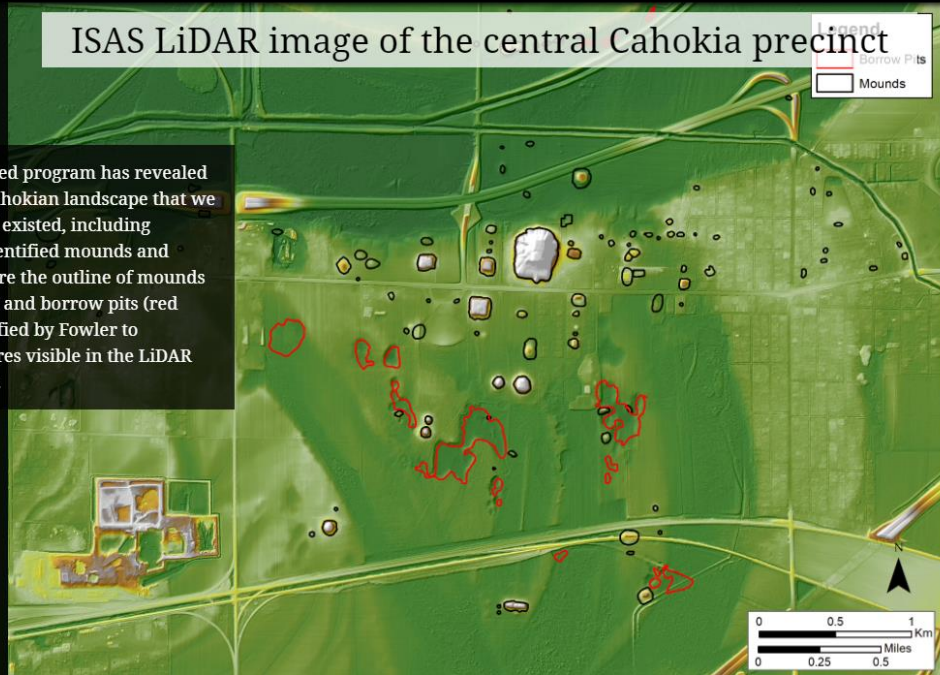
Rediscovering the Past

Exploring the Past with Technology

I Re-Envisioning Greater Cahokia

ISAS LiDAR image of the central Cahokia precinct

This computerized program has revealed aspects of the Cahokian landscape that we never suspected existed, including previously unidentified mounds and features. Compare the outline of mounds (black polygons) and borrow pits (red polygons) identified by Fowler to additional features visible in the LiDAR elevation model.



University of Illinois

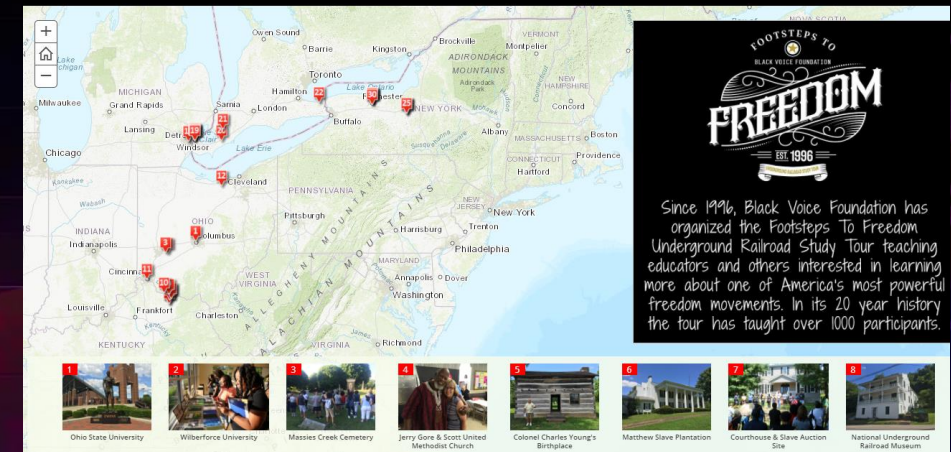
<https://univofillinois.maps.arcgis.com/apps/Cascade/index.html?appid=a58c2043100d4f3a891dc83d9bc00c2e>

Underground Railroad

Footsteps to Freedom: Underground Railroad Study Tour

July 10-17, 2016

Share with your friends



Footsteps To Freedom

<http://www.arcgis.com/apps/MapTour/index.html?appid=4c58d41064114a638a94f31a2f61d676>

Internment Camps



US Library of Congress

<https://www.loc.gov/ghe/cascade/index.html?appid=69183af8d45d4f46a9dc4eba99440891>

Science and Education

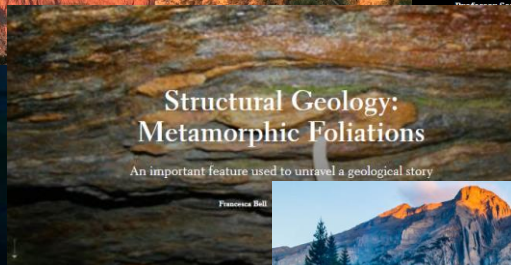
Class Material



Structural Geology StoryMaps

GEOS 350: Structural Geology & Tectonics

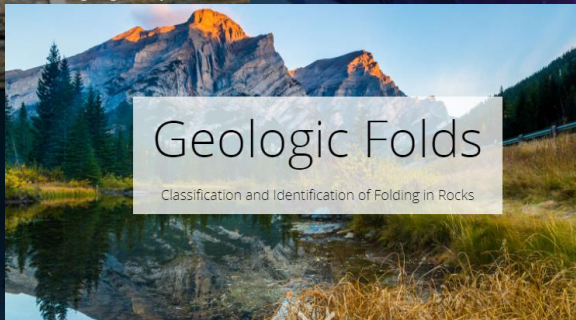
Professor Scott Wilkerson - Fall 2019



Structural Geology: Metamorphic Foliations

An important feature used to unravel a geological story

Provence Hall



Geologic Folds

Classification and Identification of Folding in Rocks

DePauw University
<https://storymaps.arcgis.com/stories/236ddc5c062e492184ca0a645e1eccc2>

Geophysical Survey



Mississippi Alluvial Plain: Shellmound, MS Geophysical Survey

A geonarrative by USGS

Summary

Geophysical Data

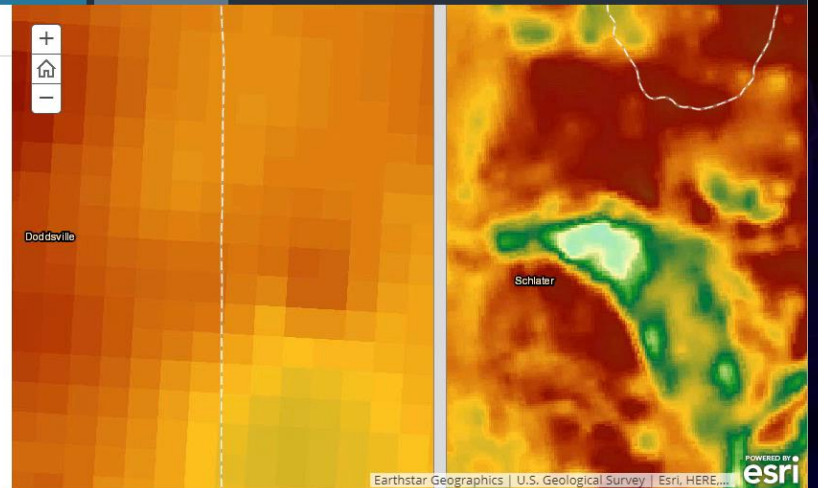
Derived Aquifer Properties

Why High Resolution?

More Information

Airborne vs. Borehole Data

Airborne geophysical data provide an excellent complement to borehole and other ground-based geological information. Co-located airborne and ground-based observations can be used to understand the connection between geophysical properties like electrical resistivity and geological properties of interest. These relationships can then be extrapolated over large areas with high spatial resolution using airborne geophysics, helping to 'connect-the-dots' between sparse ground-based observations.



esri A Story Map

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U.S. Department of the Interior DOI Inspector General White House E-Gov No Fear Act FOIA

USGS

https://www2.usgs.gov/water/lowermississippigulf/map/shellmound_SM.html

Science Communication

Virtual Guidebooks

STORY MAPS

A Geologist in Grand Canyon Storymap

Join Arizona Geological Survey geologist Steve Rauzi and a team of Conoco geoscientists as they raft through Grand Canyon examining the Precambrian Chuar Group.



STORY MAPS

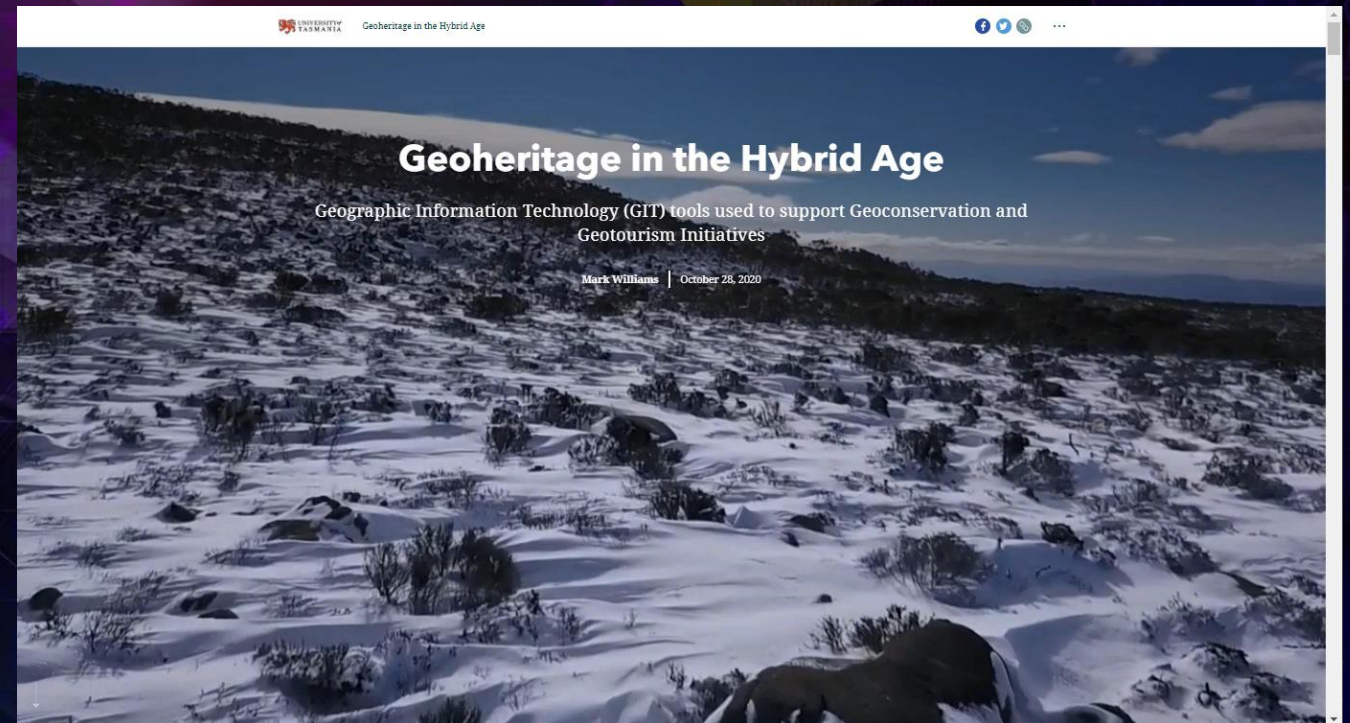
Arizona's San Pedro River Storymap

The San Pedro River is Arizona's last undammed river. Joe Cook and his colleagues at the Arizona Geological Survey recently mapped the extent of Holocene channel and floodplain alluvium there.



AZ Geological Survey & University of AZ
<https://azgs.arizona.edu/outreach-geoheritage/arizona-geoheritage>

Geoconservation and Geotourism Initiatives



University of Tasmania
<https://storymaps.arcgis.com/stories/f3fbc830c44d4f16a7f30003dc2b6714>

Integrating Sounds and Geography



Sequoia and Kings Canyon NP, National Park Service
<https://nps.maps.arcgis.com/apps/Cascade/index.html?appid=9f33fa32af394a129b0b548429dced01>



Acoustic Atlas, Montana State University
<https://storymaps.esri.com/stories/2018/sounds-of-the-wild-west/index.html>

Other Planets

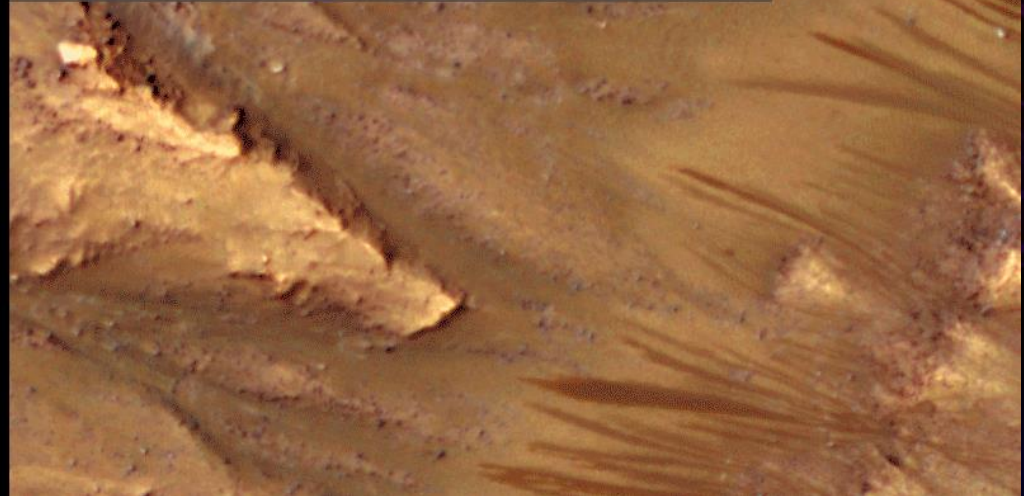
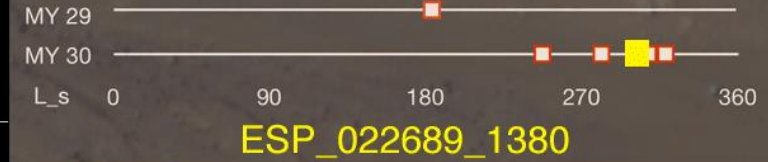
Liquid Water on Mars

A story map    

Discovering Liquid Water on Mars

Palikir Crater

Another time lapse shows dramatic streaking in Palikir, a 10-mile-wide crater within a much larger crater.



Palikir Crater of Mars.

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and moderate

NASA/JPL

<http://storymaps.esri.com/stories/2015/water-on-mars/>

Moon Mapping

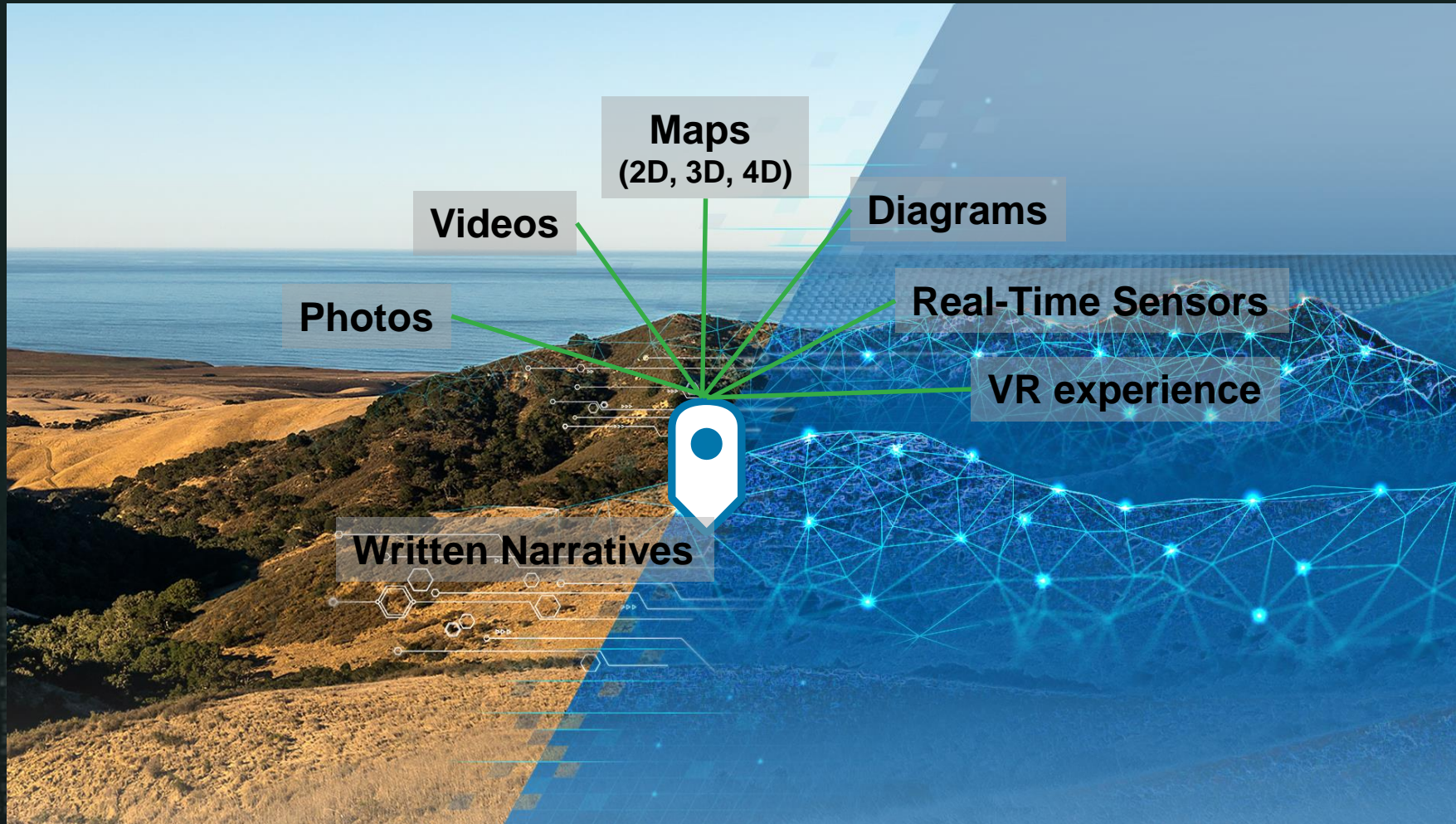
 Mapping the Moon



Ordnance Survey UK

<https://storymaps.arcgis.com/stories/65f55419593744afbec48276c6e5b63c>

Representation of Geoheritage Sites is Evolving



Using Geography to Integrate all Information

Technology is Also Helping in the Establishment of Geoheritage Sites



Ultimately We Need Digital Twins of Geoheritage Sites

Enabling Digital Exploration, Analysis, and Modeling...

Bringing Together All Information to Better Understand the Location

Making It Accessible And Engaging to Everyone

Students,
Researchers,
& the Public



This is already happening . . .



Developing a Digital Twin and Open Research Repository



Challenges . . .

- “Level Up” in technology usage
- Pace of Change
- Staying Relevant / Interesting
- Expectations Change with Technology . . .
- Persistence of the data in a digital world
- A Complete Digital Twin is a lot of work



Realizing the Vision of how Technology Continues to Transform the Geoheritage Practice . . .

. . . Requires More Than Science and Technology

Art of Storytelling

Collaborating

Envisioning Solutions

Embracing Innovation

. . . Inclusive Mindset

The Work of Geoscience Professionals Is Critical . . .

Your Leadership Is Essential



Thank You for Everything You Do.

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