

Career Pathways Across Disciplines: GeoTech + GeoThinking

Using geotechnologies, visualizations, and the Whys of
Where to blaze new trails.

Joseph Kerski
11 April 2024

**Let's begin with Web GIS! Survey123 field
survey, ArcGIS Online maps, and
dashboard.**

Today's Webinar Survey

Please fill out the following:

What is your role?

K12 Educator

Today's Workshop Survey

Survey Results are here: <https://arcg.is/n5q04>



Dashboard for Today's Webinar.

The above activity represents 4 items in the web GIS platform: Survey, map, dashboard, and story map.

Why is GIS important to your career path?

(1) It crosses boundaries.

(2) It fosters spatial and critical thinking.

(3) It is in high demand in the workforce.

(4) It is essential for a more sustainable Earth and a more resilient people.



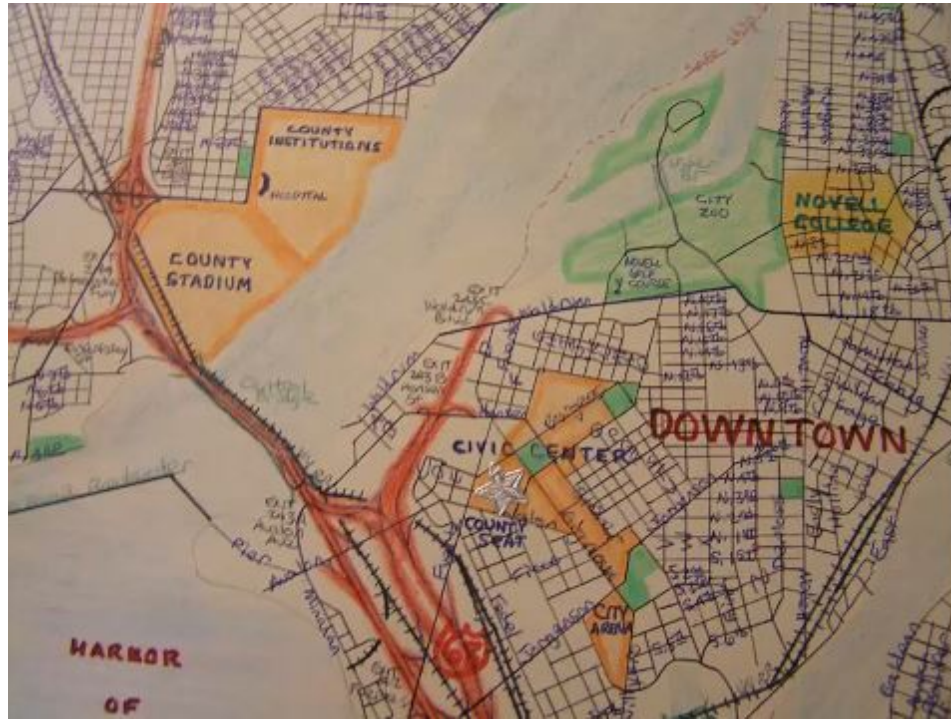
Geography and geotechnologies are essential for learning and also essential for the planet.



The 5 forces acting to position geotechnologies on the world stage.



Joseph Kerski's pathway: Nonprofit, government, academia, industry. What's your pathway?



One of the maps I made when I was a teenager.



I guess things haven't changed that much... still a geo-nerd.

Esri's 3-fold mission: Education, Sustainability, Science.

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Education



Sustainability



Science

Esri's 3-fold mission.



The largest donation of land ever given to The Nature Conservancy, by Esri founders Jack and Laura Dangermond (\$161 million). Esri also gave \$12 million to support E.O. Wilson's Half Earth Foundation.

Esri, like other organizations, depends upon and contributes to the development of science: <https://esriurl.com/scicomm> - <https://esriurl.com/agustories> and - science maps, apps and storymaps: <https://www.esri.com/en-us/about/science/maps-apps>

- Maps have become the **language** of geoscience.
- Maps **engage** people in geoscience.
- Maps **enable spatial analysis** of geoscience data.



GIS for Science--new book from Esri Press.



Esri, along with many other organizations, hires graduates-- your students!--who can think spatially and critically.

Consider Esri in your future career path, and our partner network too. Consider how you can contribute to the **organization.**

Esri Careers | Job Opportunities

Esri is an equal opportunity employer (EOE), and all qualified applicants will receive consideration for...

<https://www.esri.com/en-us/about/careers/overview?resource=%2Fcareers>



Esri Partner Network | Business Partners...

The Esri Partner Network is a rich ecosystem of organizations that work together to amplify The...

<https://www.esri.com/en-us/about/esri-partner-network/overview>



What is modern SaaS based GIS?



An example of Web GIS (ArcGIS Online) with IoT feed (earthquakes, last 30 days).

Safe Clean Water Los Angeles project - map, dashboard, more.

Spatial analysis is also playing a key role in the research, development, and education surrounding the UN SDGs.

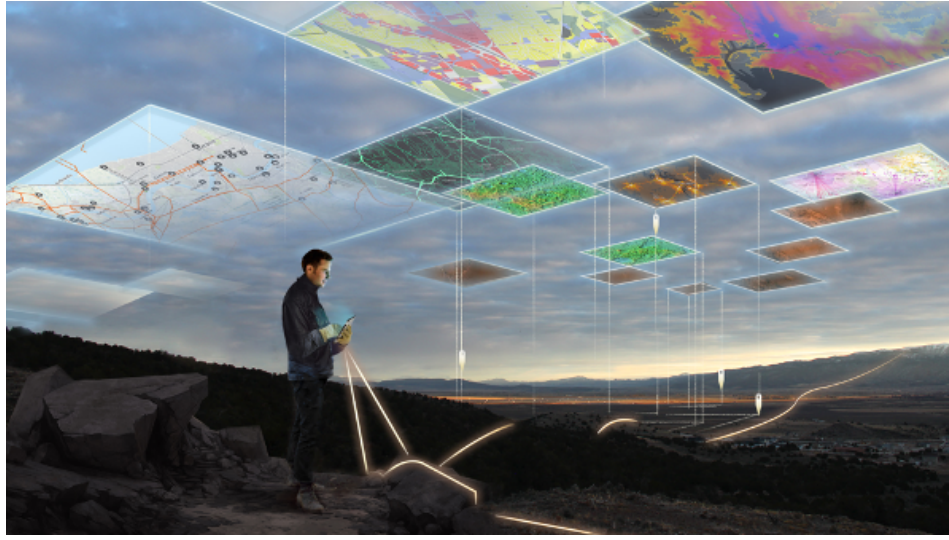
A Federated System for the Sustainable Development Goals

A Federated System for the Sustainable Development Goals

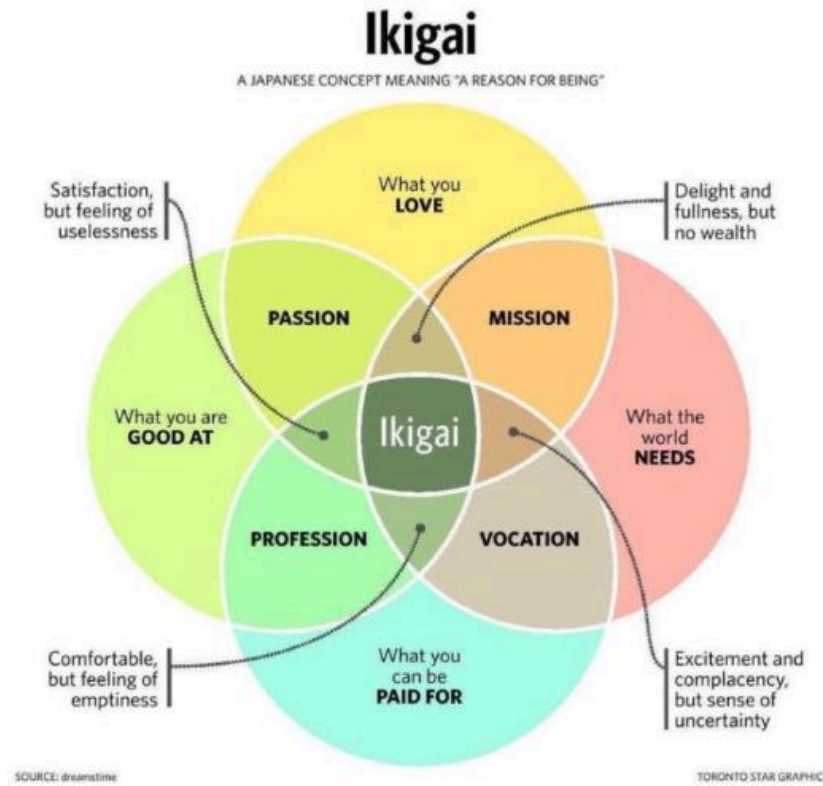
GIS is increasingly the nervous system of Planet Earth with live data feeds. Choose a live data feed that is intriguing to you:

<https://livingatlas.arcgis.com/livefeeds-status/>

Why is the live feed interesting? Why does it matter? What can you do to take action about it?



*We are living in amazing times.
We have never before been so empowered--and yet so
challenged.*



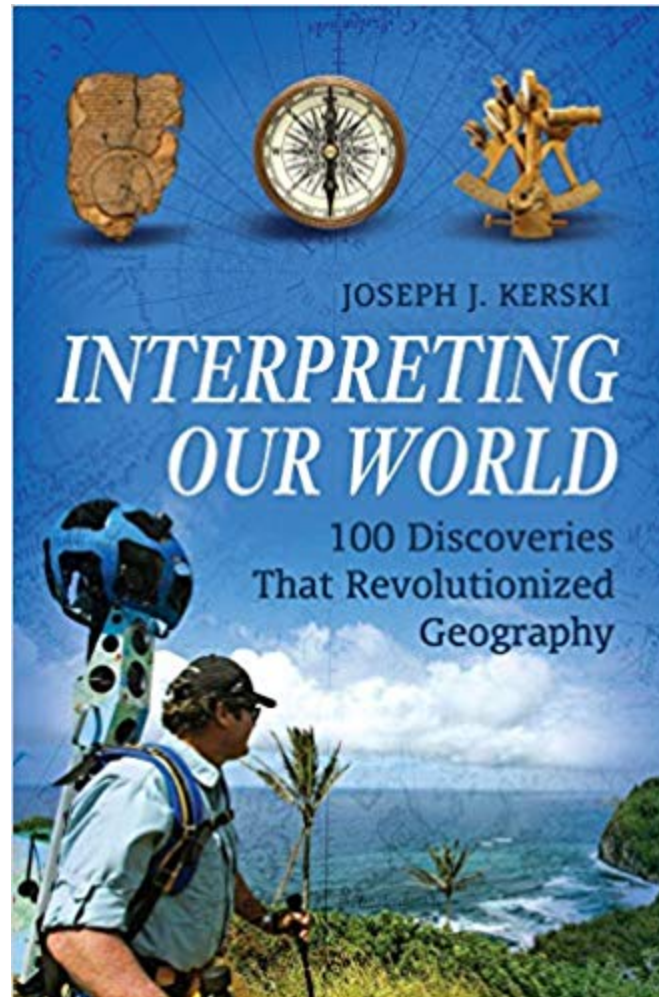
How can you use GIS in the "ikigai" zone?

Source: Dreamstime, Toronto Star graphic.

8 advantages of using GIS in your education pathway:

(1) Data fluency. (2) Systems Thinking. (3) Holistic Thinking. (4) Spatial-temporal thinking: Patterns, relationships, scale, trends. (5) Inquiry. (6) Outdoor

**education. (7) Community connections. (8)
Problem-based learning.**



Geography is actually--revolutionary!

Create a story map of your CV or resume!

Amanda Huber- Portfolio of GIS Work

Explore my cascade story map experience to learn more about how Geology + GIS = Me

<https://www.arcgis.com/apps/Cascade/index.html?appid=bc4a4fee3e88404a873277375bddf511>



Joseph J. Kerski, PhD GISP

Joseph J. Kerski, PhD GISP - selections from my CV as a story map.

<https://www.arcgis.com/apps/Cascade/index.html?appid=c84bb188001746d1a5ca43f83b366c66>



More examples, and how to do this:

Create a story map of your CV or resume!

Ever since they were created by my colleague Allen Carroll and his team, I have been an ardent...

<https://community.esri.com/t5/education-blog/create-a-story-map-of-your-cv-or-resume/ba-p/884496>



Geographic Information Systems (GIS) is evolving.

Modern GIS: (1) Cloud-enabled. Interoperable. Accessible. (2) App-based. Shareable. (3) Data and analytical tools as services. (4) Tied to major IT developments: IoT, AI, open data. (5) Tied to societal issues: Location privacy, copyright, citizen science.



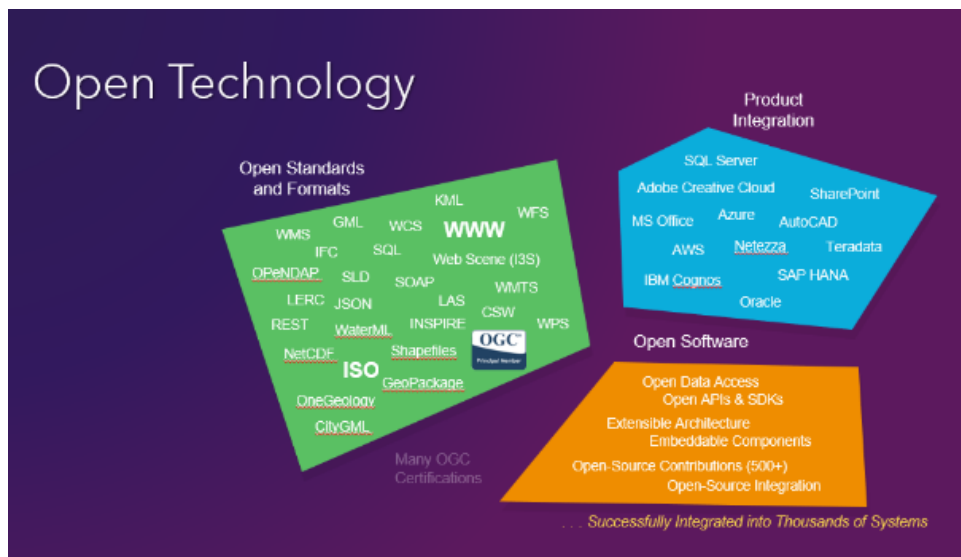
GIS has changed.

Citizen science, mapping, and analysis:

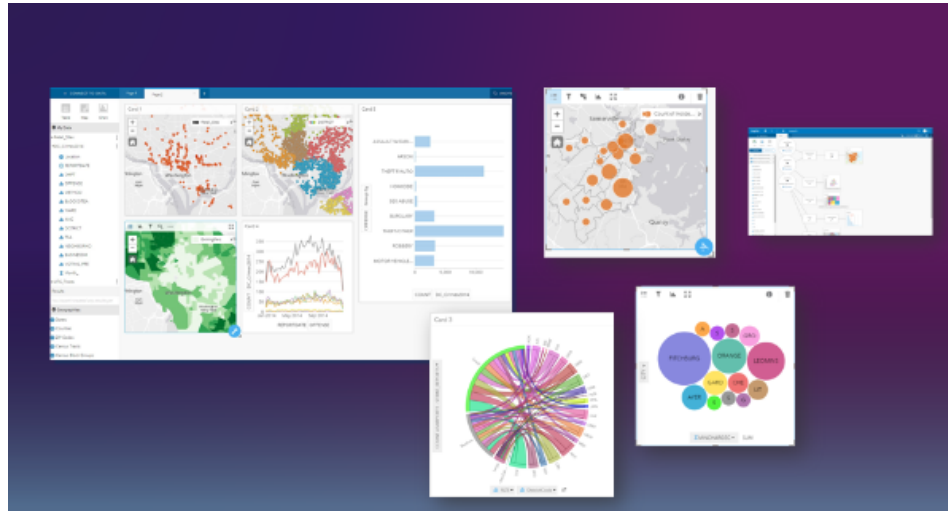
<https://esriurl.com/citizens>



Story Map Series

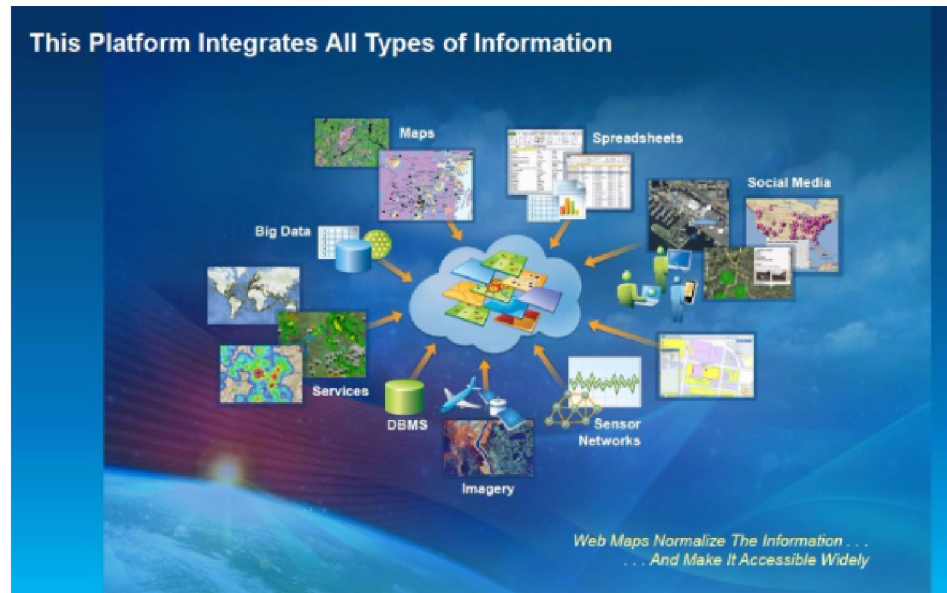


GIS is no longer a "niche" technology but embedded in mainstream IT.



Analytics as a Service provides spatial analysis tools for an increasing number of disciplines.

GIS has moved from a system of records to a system of engagement.



The GIS platform integrates all types of information.

As GIS has become a platform that integrates all types of information, maps are becoming the language of science--the language of the planet.



*Current weather--11 variables for every airport weather station
and many ocean buoys around the world--nearly 5,000 stations,
updated hourly.*



Sea surface temperature over space and time.

Example application: Modeling Seagrass: Model

relationship between seagrass habitats and ocean conditions. Seagrasses can quickly sequester up to 100 x more CO₂ and 12 times faster vs. tropical forests (Parry et al., 2007). Lack of data: Hence, AI+GIS+Machine Learning.

For every condition, seagrass habitats are predicted using the trained random forest model. Getis-Ord G_i^* statistic (Ord & Getis, 1995) is used for detecting the clusters of seagrass abundance over space-time bins. Assessing changes in the intensity of abundance at locations over time using the Mann-Kendall statistic yields emerging hot spot map.

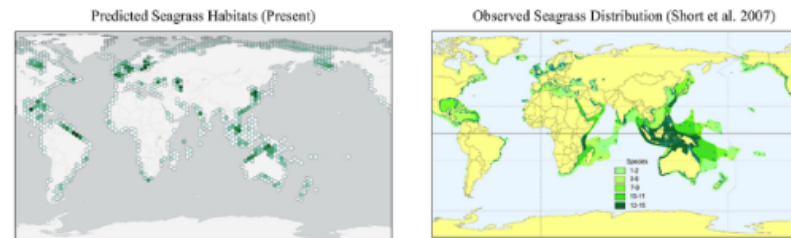
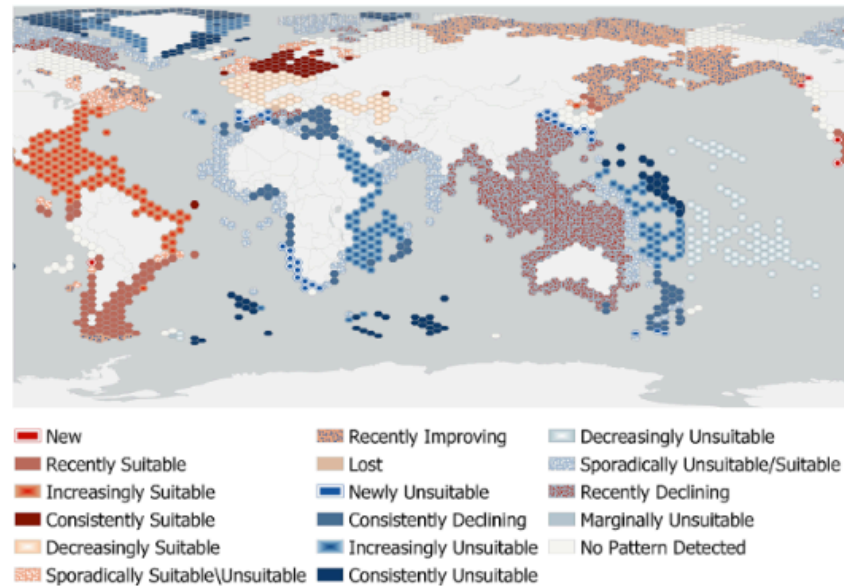


Figure 4. (a) Predicted seagrass habitats using a random forest model (dark green indicates high modelled abundance); (b) reported seagrass occurrence data by Short et al. (2007).

Traditional GIS based analyses.



Model created through the combination of GIS and AI.

Australia could lose its seagrasses under changing ocean conditions; Siberia coast may improve its suitability for seagrass habitats. The use of random forest in this AI application enables a data-driven model of seagrass habitats for world's coasts.

**Another example of AI, big data, and GIS:
Consider the following scene:**



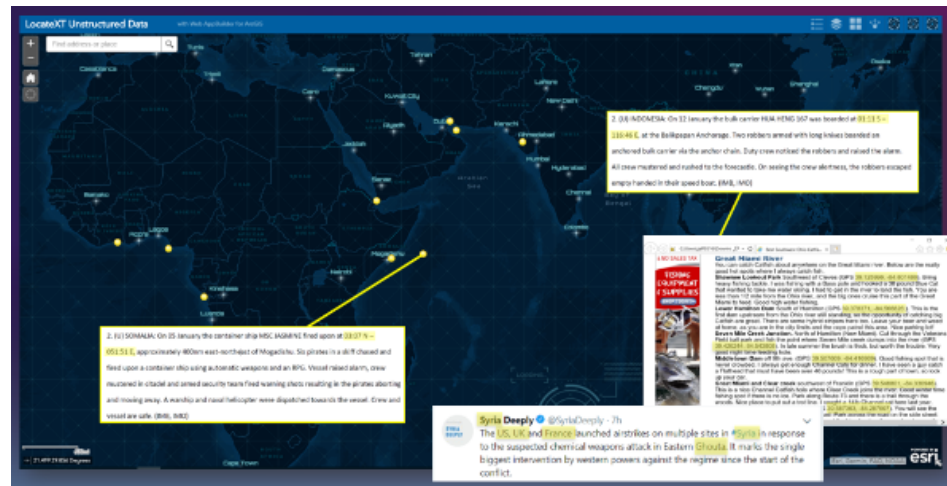
Using AI to capture and map everything in this scene--electrical infrastructure, traffic routing and amount, types of business, pavement condition, vegetation species and health, weather.

Tools

1. Survey123 field tool: Form-based survey to gather field data in crowdsourced mode.
2. QuickCapture field tool: Quickly gather field data for mapping & analysis.
3. ArcGIS Solution Community Science:
<https://doc.arcgis.com/en/arcgis-solutions/reference/introduction-to-community-science.htm>

... can be used to solicit plant and animal observations from community scientists, manage each observation, and monitor community science programs.

4. [ArcGIS Online](#): Mapping and spatial analysis in the cloud.
5. Web mapping applications: [Story Maps](#) and Dashboards.
6. [ArcGIS Hub](#): Two-way engagement with people and their communities.
7. [LocateXT](#): Extracts and maps location information from DOC files, social media, TXT, PPT, XLS, PDF, HTML, and other formats.



Locate XT tool--extracting location information from a variety of media.

Why engage with geotechnologies?

1. Teach content knowledge, skills, and the geographic perspective simultaneously.

2. An inquiry-driven, "what if" approach.
3. Applying geography to understand and solve real-world complex problems.
4. Encourages spatial thinking, scale thinking, systems thinking, and critical thinking.
5. Encourages work with data and societal issues surrounding data.
6. A purposeful use of technology that provides in-demand career skills.
7. AND THE LAST, MOST IMPORTANT REASON: _____

Great that you care about the planet! Who is going to pay you to care about the planet? **Acquire GIS and other skills to bring value through applying skills and knowledge to _____ (USGS, TPL, GSA, EPA, etc).**

Collect data but also - cultivate a love for the planet.



Guess where?

Let's get practical! How can you embrace these tools?

Ask questions, investigate, solve problems, use GIS and other investigative tools in your investigations.

Methods:

1. Use existing activities tied to interactive web maps.
2. Learn Lesson library and Esri Press books.
3. Esri MOOCs.

4. College and university degree programs and certificate programs.
5. Gather, map, and analyze data in your own community.
6. Create and give oral and written presentations with story maps.

Attitudes:

1. Examine which topics you are investigating could be enhanced through GIS.
 2. Learning a rapidly evolving technology requires you to be a lifelong learner.
 3. GIS is a system, an entire discipline (GIScience). Give yourself time for the journey. Start with something doable and achievable. But the key is to START.
 4. Don't go it alone: Network with colleagues to share ideas and best practices. Because one is the loneliest number that you'll ever...
-

Networking Opportunities

1. Associations: AAG, state GIS associations, URISA, UCGIS, then - specialized focused groups as well.
2. Conferences: Esri UC, AAG, regional AAG, EuroGeo, state GIS associations, education conferences, community science, AGU, GSA, NCGE...

3. LinkedIn and Facebook and associated groups and communities.

4. Join the Esri Young Professionals Network

Young Professionals Network | Esri YPN

Esri's Young Professionals Network (YPN) is a community for those starting out in GIS as well as...

<https://www.esri.com/en-us/about/ypn/overview>



Specialize, but also nurture the holistic, systems, geographic perspective.



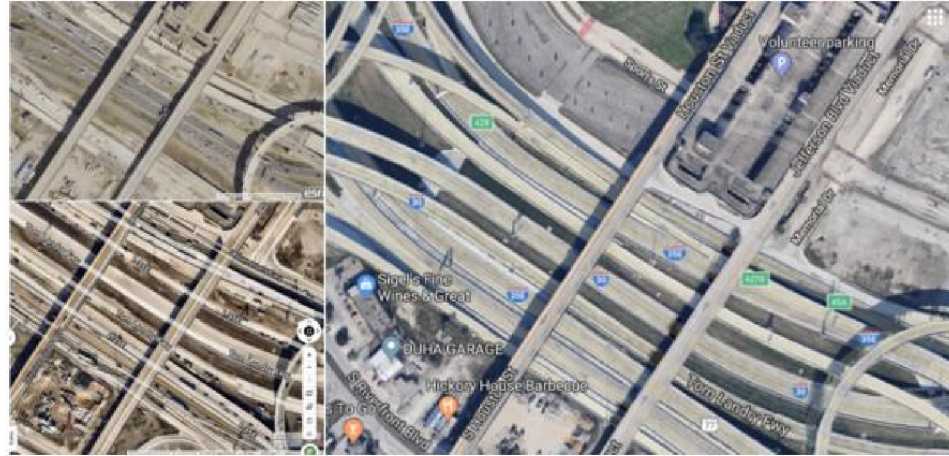
The 3 legs of the geoliteracy stool.

3 Resources:

(1) Think critically about data--including spatial data.

The Spatial Reserves data book and blog.

Example: Imagery: It is what it is. Well, not really.



What is noticeably absent on the satellite image on the right?

Example: Imagery on live web maps.



Images and vector street data are offset in China on Google Maps--which is in the correct position? Most sources say "neither".

(2) Use selected web GIS maps and apps.

≡ ECOLOGICAL MARINE UNIT *explorer*

Ecological Marine Units Explorer.

Ecological Land Units: Provides, for the first time, a web-based, GIS-ready, global ecophysiographic data product for land managers, scientists, conservationists, planners, and the public to use for global and regional scale landscape analysis and accounting,” Roger Sayre, USGS. Ecological Land Units (ELUs) are areas of distinct bioclimate, landform, lithology, and land cover that form the basic components of terrestrial ecosystem structure. The ELU map was produced by combining the values in four 250m cell-sized rasters using the ArcGIS Combine tool. (Spatial Analyst). These four components resulted in 3,639 different combinations or ELUs.

<https://www.esri.com/about/newsroom/announcements/the-most-detailed-ecological-land-units-map-in-the-world/>

- Learn more about the Global ELUs map: esriurl.com/globalelu. The story map is here: esriurl.com/elu and the data is here: <https://www.arcgis.com/home/item.html?id=77bbcb86d5eb48a8adb084d499c1f7ef>

Use activities tied to interactive maps

<https://www.esri.com/geoinquiries> - Esri geoinquiries.

<https://learn.arcgis.com> Learn Lesson Library, including climate and weather lessons:

<https://learn.arcgis.com/en/gallery/#?q=climate&t=lesson>

The screenshot shows a gallery of lessons from the Esri Learn platform. At the top, there are filters for 'Lesson X' and a 'Clear filters' button. Below the filters, five lesson cards are displayed, each with a thumbnail image, a title, a brief description, and a duration icon.

Lesson Title	Description	Duration
Downscale Climate Data with Machine Learning	Analyze the relationship between simulated global circulation model variables and energy transfer in the atmosphere.	4 hr
Interpolate Temperatures Using the Geostatistical Wizard	Try different geostatistical methods and compare their results for mapping temperature in Africa and the Middle East.	30 min
Predict Weather with Real-Time Data	Explore real-time weather data, make predictions, and interpolate surfaces.	1 hr 30 min
Explore Future Climate Projections	Answer questions about the earth's climate and map future climate models.	2 hr
Classify Land Cover to Measure Shrinking Lakes	Compare imagery to calculate area changes in Lake Poyang, China.	

Selected hands-on climate lessons.

The Urban Observatory:

<http://www.urbanobservatory.org/compare/index.html>

Visualizing and understanding migration over space and time.

Multimedia interactive

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

The Esri Living Atlas of the World.

<https://livingatlas.arcgis.com> A curated, authoritative library of hundreds of data sets from government, industry, and nonprofit data contributors from all over the world.

Wayback

imagery: <https://livingatlas.arcgis.com/wayback/> Examine change over space and time with high-resolution imagery for the entire planet. New in November 2020: Swipe tool to compare imagery!

IoT: Water Balance App: <https://livingatlas.arcgis.com/waterbalance/>

Earth investigations: Name that place:

Presentation

No description

<https://www.arcgis.com/apps/presentation/index.html?webmap=f95d562571d740a6840254ee53ae3024>

Historical imagery in ArcGIS Online.

(3) Use the tools in combination -- they are all part of a web GIS platform. Example: field survey, story map, and Operations Dashboard.

Walkability

Harness the power of maps to tell stories that matter. ArcGIS StoryMaps has everything you need...

<https://storymaps.arcgis.com/stories/1e4847f78ec94fd89e960adfabb5ac5c>

You are learning a SYSTEM | There is no single pathway.



There is no 1 single pathway when learning GIS -- that is the appeal, and also the challenge.



Selected Esri Press books.

What is the best tool to use?



Don't get too tied to the tools. What is the best tool to use?

Consider the implications when cholera was found to be a water-borne human-caused illness.

GeoInspirations

<https://www.directionsmag.com/playlist/6651>

GeoInspirations

Directions Magazine has been privileged to work with some of the most influential minds in the...

<https://www.directionsmag.com/playlist/6651>



The 6 most important skills

1. Ask questions.
2. Be able to work with data.
3. Understand your geoscience foundations.
4. Be an adaptable lifelong learner.
5. **READ! Even outside your own subject and genre.**
6. Nurture your communications skills.

Elevator speech on why GIS matters to society



Elevator speech on why GIS matters to society.

***We have skilled, energetic people,
powerful tools, and rich and varied data.
We can solve these problems. As a***

geoscientist, you have a critical role in shaping the future!



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